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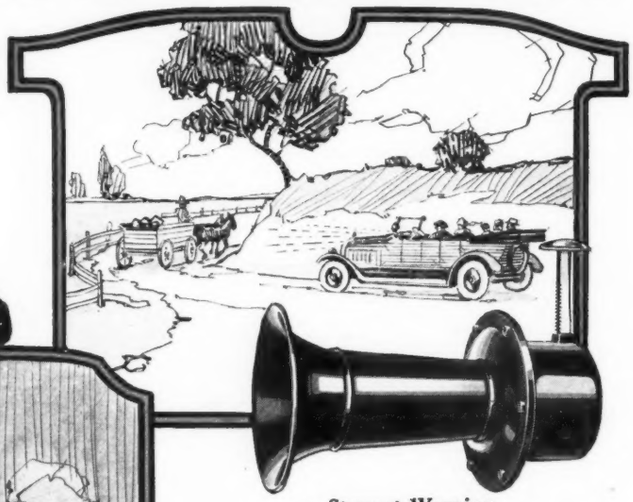

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, MAY 22, 1919—CHICAGO NO. 21

Transatlantic Flight Achieved

American Naval Airplane Reaches Azores; British Machine and Crew Are Lost

NC-4 Reaches Ponta Delgada, 1350 Miles from Trepassey Bay, After 17:02 Hours in Air—Hope Abandoned of Finding Hawker, the Sopwith Pilot, Who Left St. John's Sunday Night

THE Atlantic Ocean has been crossed in the air, and it was an American flying boat, manned by members of the United States Navy, that accomplished the historical feat. Lieut.-Commander Albert C. Read, piloting the Navy flying boat NC-4, reached Ponta Delgada at 1.50 p. m. (New York time) on May 19. After having completed the major part of the task of crossing the Atlantic, the plane is awaiting favorable wind to complete the journey to actual European soil, Lisbon being the selected landing place. From Trepassey Bay to Ponta Delgada the NC-4 was in the air 17:02 hours, traveling 1350 miles at an average speed of 79 miles an hour. The leg of the flight remaining is only 800 miles.

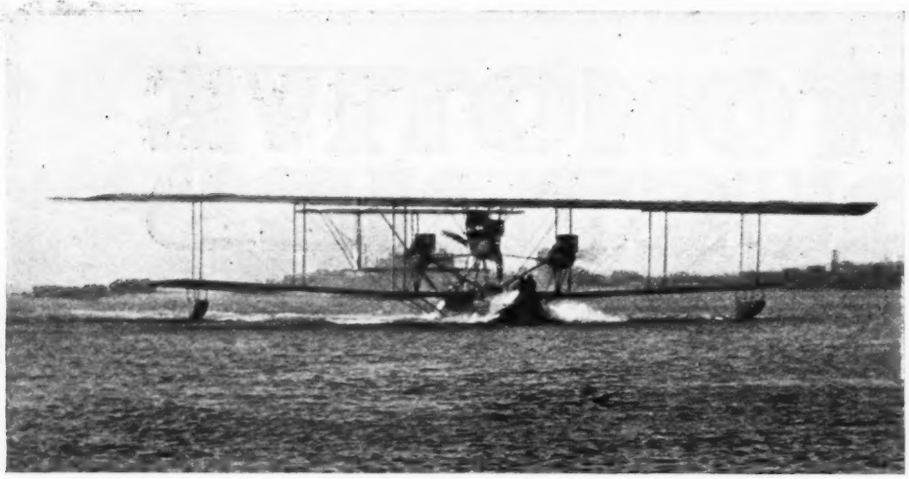
It was 100 years ago this month that the Savannah, an American built steamship, made the first trip across the Atlantic under man-made power.

Ever since Bleriot crossed the English Channel in an airplane in 1909 people interested in aircraft have looked forward to the date when the first transatlantic flight would be made in a heavier-than-air machine. It is an immense step from the twenty-odd miles of the cross-channel flight to the more than 2000-mile trip of NC-4 from Newfoundland to Portugal, and the difference in the two performances is a measure of the progress made in aircraft design and construction in the short span of ten years. The feat of Lieut.-Commander Read and his gallant crew will live in history both as a daring exploit crowned with success and as a milestone in the annals of mechanical flight.

Only one of the three NC boats which left Rockaway, N. Y., on May 8, succeeded in reaching the opposite side of the Atlantic. The NC-1, in charge of Lieut.-Commander Bellinger, was forced to alight on the ocean off the Azores in bad weather and was severely damaged. The crew were saved by a passing ship, but the plane was lost. Commander Towers' "flagship," the NC-3, got off its course when nearing the Azores, ran short of fuel, and had to alight on the ocean in foggy weather with heavy seas. It reached Ponta Delgada, Azores, under her own power, but was so seriously damaged by the buffeting she received that it was decided to disassemble her and ship her back to New York on one of the Navy vessels.

Lieut. Read's craft, the NC-4, which was pursued by ill luck during the first stage of the flight from Rockaway, N. Y., to Halifax, N. F., made the flight from Trepassey to Horta, Azores, without incident. She obtained a lead of about 30 minutes on the other planes and in consequence escaped the fog and heavy weather near the Azores that proved to be their undoing. On May 20 the NC-4 flew from Horta to Ponta Delgada, a distance of 150 miles, in 1 hr. 44 min., making its average speed for this distance 86 m.p.h. It was from Ponta Delgada that the last stage of the long air voyage was started.

The real start of the transatlantic flight was made



The NC-4 starting on her transatlantic flight. Leaving Trepassey, N. F., on the evening of May 16, the boat, after 17:02 hr. of continuous flight, reached Ponta Delgada May 19

Lieut.-Commander Albert C. Read, Commander and Navigator of the NC-4

from Trepassey, N. F., on the evening of May 16. The NC-4, which was belated in its arrival at Trepassey owing to a number of mishaps on the first leg of the long journey, had replaced one of her engines during the night. Mechanics worked on the machine all day. Her wings were given a thorough inspection, and the engines were warmed up and given their finishing touches during the afternoon. First to get away was the NC-3, which started at 4.36 p. m., Washington time. NC-1 followed at 4.56 p. m., and NC-4 at 5.13. The boats did not make directly for the Azores but practised around the harbor to warm up their engines.

Most extensive preparations had been made by the Navy to insure the safety of the crews in case there should be any accidents. No less than 22 cruisers and destroyers were stationed on the way between Trepassey and the Azores. With a total distance of about 1200 miles, this makes only a little over 50 miles between stations.

The following is condensed from an official log on the flight, compiled by the Navy Department from reports sent in by the station ships:

NC-4 First to Be Heard From

The NC-4 took off the water at 5:36 p. m., Washington time. After having circled Trepassey harbor it alighted at 5:53 p. m. It took off the water again at 6:07 p. m., and immediately started for the Azores. The NC-3 left the water for the Azores at 6:06 p. m., and the NC-1 at 6:09 p. m. All three machines passed from sight at 6:20 p. m.

The first of the three boats to be reported from the Azores was the NC-4 piloted by Commander Read. A dispatch from Horta, Island of Fayal, under date of May 17, conveyed the information that in view of thousands of persons the NC-4 arrived at Horta Bay, having been on the way from Trepassey 15 hr. and 18 min. Both crew and machine were in first-class condition. Most of the distance was covered at an altitude of 3,000 ft., but when about 200 miles from the island of Corvo, the first island of the Azores to be sighted, Commander Read had dropped to an altitude of 1,000 ft., owing to a heavy fog. Three ships were passed on the way. The crew subsisted on sandwiches, and had no sleep during the whole trip.

The other two machines lost their bearings in a heavy fog. The NC-1 was forced to alight off Corvo Island, and the NC-3 alighted off the island of Fayal. Both of them established wireless communication with American destroyers and a search for them was begun at once.

Commander Read of the NC-4 deemed it wise to alight at Horta, rather than go on to Ponta Delgada, owing to the unfavorable weather conditions. The trip of the NC-4 from Trepassey Bay to Horta, 1,200 miles, constitutes the longest overseas flight on record. So far as representatives of the U. S. Navy at Ponta Delgada were concerned, the NC-1 and NC-3 were practically lost for 10 hrs. Then their positions were located by means of directional wireless.

After the start from Trepassey, the three machines remained close together for a considerable time, but finally the NC-4 drew ahead. The progress of the different machines, as reported from the station ships, was as follows (New York time):

NC-1 passed ship No. 2 at 7:35 p. m., No. 3 at 8:03 p. m., No. 6 at 10:05 p. m., No. 13 at 3:13 a. m., No. 16 at 6:07 a m., No. 18 at 6:14 a. m.; No. 20 at 8:10 a. m.

The NC-3, which started from Trepassey at 6:03, passed station ship No. 2 at 7:35 p. m., No. 6 at 10:05 p. m., No. 7 at 10:58 p. m., No. 9 at 12:10 a. m., No. 13 at 2:23 a. m. and No. 17 at 5:15 a. m.

The NC-4, which started from Trepassey at 6:07, passed station ship No. 2 at 7:35 p. m., No. 6 at 10:05 p. m., No. 8 at 11:29 p. m., No. 11 at 1:50 a. m., No. 14 at 3:06 a. m., No. 16 at 4:30 a. m., No. 18 at 5:45 a. m., sighted land at 7:35 a. m., passed No. 22 at 8:10 a. m., and arrived at Horta at 9:25 a. m.

No mishap or incident of any kind occurred to the NC-4 during the entire voyage and the machine was found to be in perfect condition upon its arrival at Horta.

Full moon-light favored the flight during the early part of the trip. The average speed made by the NC-4 was more than 75 miles per hour. At Horta a section of the harbor had been specially prepared for the plane. Two American destroyers were at hand, ready to assist the planes if they should alight outside of the breakwater and need assistance. Most of the American naval officers at the port remained up all night to follow the progress of the planes by means of the wireless reports. The wireless worked perfectly throughout the night, merchant ships and radio stations heeding the request of the Navy to refrain from interfering with messages regarding the flight.

At 11:40 a. m., New York time, a report was received at Horta from the NC-1 that she had been blown off her course, and had been forced to alight in the open sea, 200 miles northwest of Fayal. Four destroyers were immedi-

ately sent to her assistance. From the NC-3 a report was received at 5:15 a. m., New York time, that she was off her course between stations 17 (Destroyer Stockton) and 18 (Destroyer Craven).

The weather was fair during the first part of the trip, but heavy fogs were encountered by the NC-1 and NC-2 after passing station 17, the NC-1 being forced to descend to the surface of the ocean. The crew of the NC-1 was rescued by the Steamship Ionia, east of Flores and Corvo of the Azores group, about 110 miles west of Fayal. When a wireless was received at Horta from the NC-1 to the effect that she was lost in the fog about position 20, the destroyers Phillip, Waters, Harding and Dent were sent in search of the missing plane.

After a search lasting until well into the afternoon, the Harding got into communication with the NC-1 and reported her position. The Harding at once started off in the direction from which the signals came, at a speed of 22 knots. She reported that the wireless calls of the plane became more distinct as she approached. At the time, the Harding cannot have been so very far away from the plane, as the latter when on the surface of the water can use only her weaker radio set, the more powerful set being available only when the propellers are working and the craft is in the air.

The NC-3 had not been heard from since 5:14 a. m., at which time she was approximately 265 miles off the port of Horta.

News of the arrival of the NC-4 at Horta reached the Navy Department at 10:59 a. m. on May 17.

The first official news of the difficulty experienced by the NC-3 arrived at Washington at 11:06 in a cable dispatch from Admiral Jackson on the Melville, in which he reported that the NC-1 had passed station 19, and NC-4, station 22. In this dispatch Admiral Jackson said that the NC-3 was between station No. 16 and station No. 18 at 5:15 a.m. (Washington time) but off its course. In the same message the weather was reported to be foggy.

A report of the experiences of the crew of the NC-3 was made by Commander Towers to the Navy Department, and was given out officially on May 20. This shows that the plane was forced to alight on the ocean at 9:30 a. m. (New York time) on May 17. Commander Towers had then only 2 hours' fuel supply left, and from the time he came down until he reached Ponta Delgada his machine was buffeted by heavy seas, and was in a precarious situation for something like 52 hr.

When the NC-3 alighted on the ocean, she was about 85 miles south of the straight course between Newfoundland and the Azores. In alighting the center forward engine strut was seriously damaged, and during the trip to Ponta Delgada the machine lost both wing pontoons, the first about 4 hr. before she reached port, the second, just before she entered the harbor. Ponta Delgada was reached at 1:50 p. m. (New York time) on May 19.

In his report Commander Towers says that he was compelled to go above the clouds at station No. 8, on account of the failure of the light on the pilot instrument board, and the necessity of having the heavenly bodies for reference. The last destroyer sighted was No. 13. The plane came through the clouds at daybreak, but destroyer No. 14 was missed. Commander Towers believes that he was thrown off his course by the high velocity of the winds at the higher altitudes, but says he followed a parallel course. Heavy rain squalls were encountered at 3:45 a. m. on May 17, which continued until 9:30 a. m., when the weather cleared. At that time, after considering the fuel supply, it was decided to land and make observations.

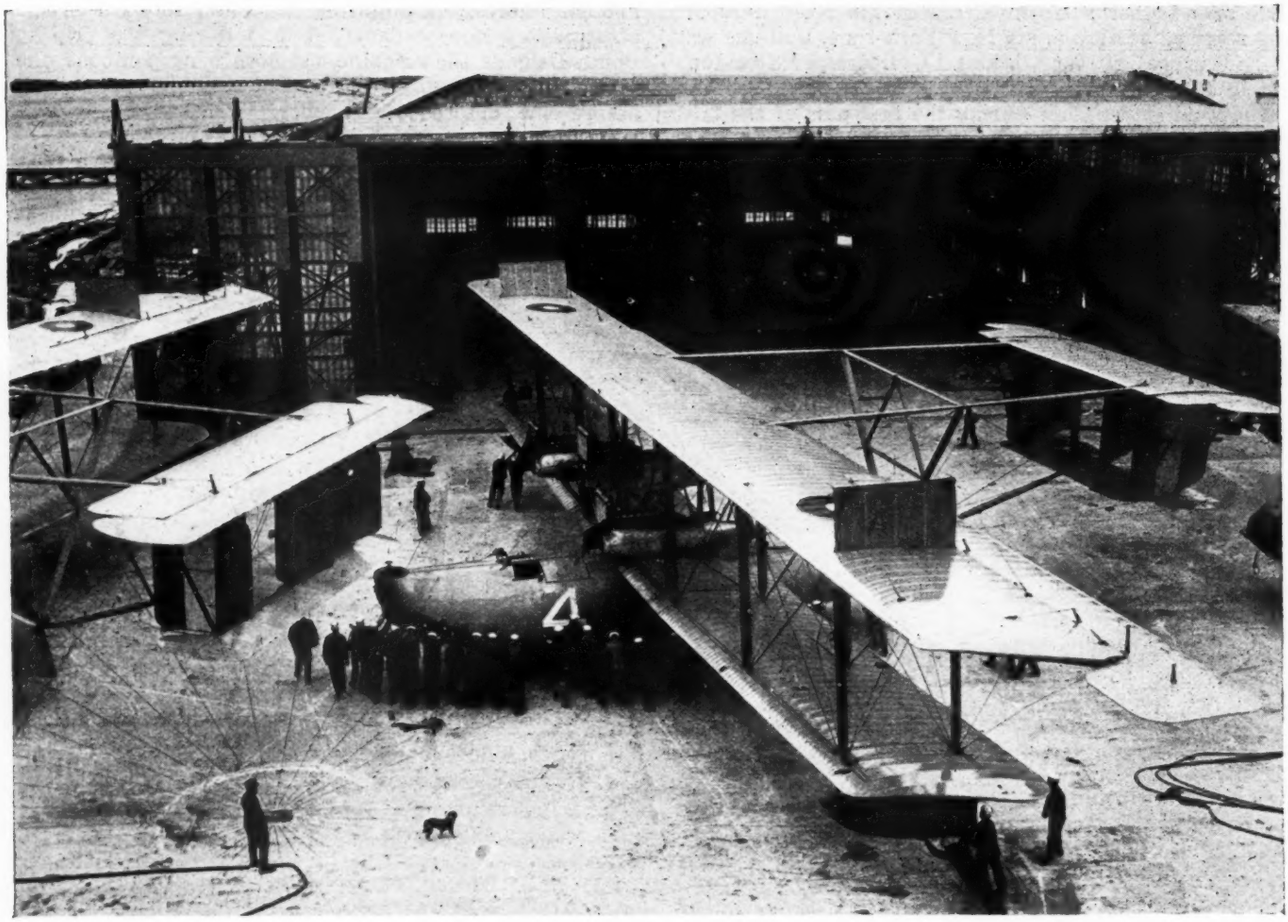
A heavy sea was running at the time, but this was discovered too late to remain in the air. In alighting, slight damage was done to the hull, but the center forward engine strut was badly damaged, and this made it impossible to leave the water again. A gale arose on the evening of the 17th, which was ridden out successfully until 5 a. m., New York time, May 19, when the port wing pontoon was lost. From the latitude and longitude given in Commander Towers' report, it is figured that he alighted on the water 90 nautical miles due south of station 22 (Destroyer Harding). This is about 95 miles from Horta and 200 miles from Ponta Delgada. The NC-3 sailed the entire 205 miles from her landing place to Ponta Delgada under her own power.

When the crew of the NC-1 was picked up by the steamer Ionia on Saturday afternoon, May 17, after they had been tossed about in the water for over 5 hr. they were greatly fatigued and suffering from sea-sickness. The plane was severely damaged by the heavy seas, and was almost a total wreck. A statement was made by Commander P. N. L. Bellinger of the NC-1 on May 19, from which we extract the following:

> The NC-1 was the last plane to take the air at Trepassey, at 6:10 p. m. (New York time). She proceeded on her course, being guided by the smoke and searchlights from the destroyers, and the star shells sent up by them. No trouble was encountered until the machine ran into a fog at

Dimensions and Characteristics of the NC Type of Flying Boats

Engines	4 Liberty
Power	1600
Span	126 ft. upper, 94 ft. lower
Length	68 ft. 3½ in.
Height	24 ft. 5⅛ in.
Chord	12 ft.
Gap	13 ft. 6 in. to 12 ft.
Wing curve	R. A. F. 6
Wings to hull	3 deg.
Engines to hull	0 deg.
Stabilizer to hull	2 deg.
Dihedral	0 deg. upper, 3 deg. lower
Wing area	2380 sq. ft. (incl. ailerons)
Aileron area	265 sq. ft.
Stabilizer	268 sq. ft.
Rudder	69 sq. ft.
Elevator	240 sq. ft.
Fin	79 sq. ft.
Weight empty	15,874 lbs.
Weight loaded	28,000 lbs.
Useful load	12,126 lbs.
Gravity tank	91 gals. capacity
Fuel tanks	1800 gals. capacity
Oil tanks	160 gals. capacity
Maximum speed	74 knots for 28,000 lbs.
Minimum speed	58 knots for 28,000 lbs.
Maximum speed	84 knots for 24,000 lbs.
Minimum speed	55 knots for 24,000 lbs.
Center of gravity	35 to 45% of wing chord
Factor of safety	3 for 28,000 lbs.



The NC-4 at its hangar

7:10 a. m. (New York time) on May 17, near station 18.

After being in the fog for some time, Commander Bellinger alighted on the water at 9:10 a. m. on May 17. The machine kept to its course until it struck the fog, when the pilot lost his bearings. It was deemed advisable to head into the wind, toward land, to take bearings before proceeding. Up to that point, the machine had been flying at an altitude of 3,000 ft., and now she dropped to 50 ft. in order to get sight of the water.

It was then found that the wind was in a different direction at the low altitude. It was also found that the fog was denser at the lower altitude. A good landing was made on the sea, which was rough and choppy, with heavy swells. The strong wind continued until the crew was picked up by the Ionia.

The mast of the Ionia was sighted at 2 p. m. (New York time), the ship being on its way to Fayal and Gibraltar. It was impossible for the crew of the NC-1 to see the hull of the Ionia, and as the vessel did not have wireless, it was impossible to communicate with her. The NC-1 therefore taxied toward the vessel, and soon they were sighted and a boat was lowered, which picked up the crew at 2:20 p. m. The position of the NC-1 when picked up was 30 deg. 15 min. longitude, 39 deg. 58 min. north latitude. An attempt was made to salvage the plane, but the tow line of the Ionia broke and the attempt was given up.

Considerable difficulty was encountered in rescuing the crew of the NC-1, as the small boat of the Ionia was tossed about like a cork. All of the crew was seasick, but otherwise they were not suffering. S O S calls were sent out by the NC-1 after alighting on the water, but the sending radius of the radio was then only 50 miles. While the crew was waiting for the rescue, they intercepted messages sent from one destroyer to another. The last radio picked up from the NC-3 was at 9:15 o'clock on Saturday morning.

Commander Bellinger stated that if the fog had not been so thick, they could have continued to Ponta Delgada. Their engines worked splendidly throughout, and the plane proceeded at an altitude varying from 500 to 3,500 ft.

Leaving Rockaway

The three NC planes of the U. S. Navy made their getaway from the Rockaway Air Station at 10 o'clock on Thursday morning, May 8. The NC-3, flagship of Commander Towers, which was piloted by Commander H. C. Richardson and Lieut. C. H. McCullough, was the first machine to start. Forty-nine seconds later the NC-1 went into the air, followed after another minute by the NC-4. The NC-1 and the NC-3 arrived at Halifax at 7 o'clock, p. m., and a report of their arrival was sent to the Navy Department at Washington by the U. S. S. Baltimore, the station-ship at Halifax. The planes made the trip of 540 nautical miles in a little less than 9 hr.

A third plane, the NC-4, commanded by Lieut.-Commander A. C. Read, had not reported at Halifax up to 8.30 p. m. Early in the afternoon, the NC-4 reported

that one of her engines was out of commission and that she was running with three engines. Later it was reported that the trouble had been corrected. Between 2 and 3 o'clock during the afternoon, the NC-4 was reported as having passed the first of the destroyers, stationed on the long lap starting at Chatham lighthouse. The machine had to make a landing at Chatham, Mass., where she was detained for several days while two of her engines were being replaced. She joined her two sister planes at Trepassey before the final "hop off."

The F-5 Navy blimp escorted the three seaplanes beyond Fire Island, and then returned to its base at Rockaway Beach shortly after 11 o'clock, a.m., on Thursday, May 8.

The second stage of the journey, from Halifax to Trepassey, was made by the NC-1 and NC-3 on Saturday, May 10. The NC-1 arrived at Trepassey at 4.14 p. m. in perfect condition after a 460-mile flight. The navigator of the NC-1 followed the precise course laid down in advance, but owing to low visibility was able to see only a few of the destroyers lining the course. The NC-3 met with a mishap on the way and had to return to Halifax, but made a second start later in the day and arrived safely late in the evening.

Hawker Not Heard From After Start

HARRY G. HAWKER and Lieut.-Commander McKenzie Grieve, the crew of the Sopwith biplane which had been waiting at St. John's, N. F., for over a month for favorable weather to cross the Atlantic, finally made off on May 19 at 1.51 p. m., New York time. No doubt the start of the NC flyers from Trepassey Bay and the successful arrival of the NC-4 at the Azores were factors in urging the British aviators to get started.

About an hour later, Frederick T. Raynham and his navigator, Capt. C. W. F. Morgan, another crew, also made an attempt to get into the air, but in trying to do so they broke the axle of their landing gear, and their machine was completely wrecked, both aviators being painfully injured. The machine which Capts. Raynham and Morgan were to pilot across the ocean was a Martinsyde.

Only about 100 persons were present when the Sopwith of Hawker went into the air. The machine ascended in spirals up to an altitude of about 2000 ft., and then Hawker flew directly east over the city, which lies 5 miles from the Mt. Pearl Airdrome, from which the start was made. Favorable weather conditions attended the start, the sky being cloudless, and only a moderate breeze blowing.

A few minutes after his start, Hawker passed Quidi Vidi Lake, alongside of which the Martinsyde Airdrome is located. As Hawker passed the Martinsyde Airdrome he cast off his landing gear, which was held on by a special tripping device to make this possible. This reduced the weight of the Sopwith by about 400 lb., and it was estimated that it would increase its speed by about 8 miles per hour. This was at once a notice to Raynham and Morgan that Hawker was off for good.

From Signal Hill, an eminence overlooking the St. John's harbor, the machine could be seen for about 10 min. longer. At the time it passed from view it was heading directly for the Irish Coast at a speed probably exceeding 100 m.p.h., as it was favored by a strong breeze.

While the weather conditions at St. John's were very favorable to the flight, those reported about the same time from Ireland were most unfavorable, there being a marked depression in that area, with rain and fog.

As Hawker and Grieve were contending for the *Daily Mail* $50,000 prize, their start had to be officially confirmed. Major Partridge, who acted as official starter, arrived at the Airdrome at 3 p. m., at which time the Sopwith had already been brought out in the open, its engine started, and everything made ready for the "hop off."

Hawker and Grieve wore heavy woolen clothing, and over that inflatable rubber suits which, it was figured, would keep them afloat for 48 hr. in case they should be thrown into the sea. They carried with them a non-sinkable boat, which was built into the fuselage of the plane, to which they intended to take in case it was necessary for them to alight on the surface of the water.

The Sopwith, with which Hawker and Grieve started from St. John's, and the Martinsyde, with which Raynham and Morgan were to make the trip, are craft of an entirely different type from the NC boats with which the U. S. Navy is making the flight. The British machines are very much smaller, and have only a single engine each. Hawker's Sopwith has a wing span of 46 ft. and an overall length of 31 ft., while Raynham's Martinsyde has a wing span of only 41 ft. and length of 26 ft. The Sopwith is equipped with a 350-hp. Rolls-Royce engine, while the Martinsyde engine only rates at 275 hp.

But while the British craft are smaller, they are speedier than the American machines. The Sopwith is rated at 100 m.p.h., and with the landing gear off she is expected to attain a speed of 106 m.p.h. Raynham's Martinsyde was a much faster machine, and was expected to make at least 124 m.p.h. with a normal load and 110 m.p.h. with the excess fuel cargo required for the long ocean flight.

Both of the British competitors intended to compete for the $50,000 prize of the London *Daily Mail*, which is for the first transatlantic flight completed in one stage, in 72 hr. It was the intention of both of the contestants to alight at the Brooklands Airdrome, near London. Commander Grieve, Hawker's navigator, expected to fly due east about 600 miles, and then turn into the transatlantic shipping lane. Capt. Morgan, of the Martinsyde, on the other hand, intended to take the direct course for Ireland, thus shortening the flight by several hundred miles.

Both navigators of the British machines relied upon their sextants and compasses for their bearings, and expected to make use of special tables in making their calculations.

At the time of this writing, Wednesday morning, no word has yet been received from Hawker and Grieve, and fears are developing that they have been lost at sea. At first there were various rumors that the Sopwith had been observed within a 100 miles of the Irish coast and another rumor was to the effect that a Sopwith machine had been observed floating on the ocean 40 miles west of the mouth of the River Shannon, but all these rumors proved without foundation. It is the belief of the British Admiralty that Hawker suffered an accident shortly after his departure, for absolutely no wireless messages were received from him, not even a farewell message.

Crowds of people waited all day Monday at the Brooklands Airdrome, where Hawker intended to land, although aircraft experts had expressed doubt that he would be able to fly the entire distance with his fuel supply. The weather off the Irish coast on Monday was boisterous, with rain and a gale.

Air Mail Service Profitable in First Year of Operation

COSTS AND REVENUES

Revenue from airplane postage		$159,700
Saving in railway transportation		2,264
Total revenue and saving		161,964
Cost of operation	$137,900	
Loss, Standard Plane No. 3, less salvage of useful parts	4,961	
Total cost of operations		142,861
Surplus		$19,103

The consolidated cost sheet for the year shows the total cost of operations of the route to be $137,900.06, apportioned as follows: Cost per mile of overhead $0.2829; cost per mile of flying, $0.2029; cost per mile of maintenance, $0.4081.

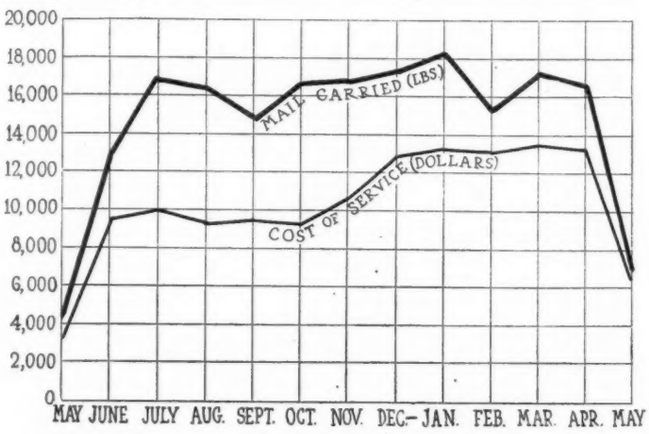
By Allen Sinsheimer

WASHINGTON, May 17—The first year of operation of the Air Mail Service between Washington and New York has particular significance because, as the first commercial aeronautical venture in this country, it indicates the possibilities of future commercial aviation, and the record of the first 12 months reveals definitely that commercial aviation is already an established fact, profitable, successful and without physical hazards.

There were no deaths resulting to the pilots carrying the mails and no instances of airplanes falling. A total of 128,256 miles was flown out of a possible 138,310 miles, 92.73 per cent of the total possible mileage. An aggregate of 193,021 lb. of mail was carried with a revenue of $159,700 and a service cost of $137,900.06. Letters carried total 7,720,840 for the year. Twenty-seven airplanes were used in the service at an average cost of $0.899 per mile each, which includes gas, grease and oil, office organization, the use of motorcycles and trucks, rent, light, fuel, power, telephone and water, miscellaneous, pilots' wages, mechanics and helpers, repairs and accessories, interest on investment, and departmental overhead. The interest on investment is a charge against the total cost of all expense incurred not including department overhead, which is considered separately. It includes a total of the cost of the planes, the landing fields, emergency fields, hangars and complete equipment.

The accompanying chart shows clearly that the commercial flying can be maintained successfully both winter and summer and that the planes can combat gales and winter conditions regardless of their severity. Starting in May, 1918, the planes traveled 78 per cent of the possible mileage, 94 per cent in June, reaching 100 per cent in September. The record fell in November and December, corresponding with the increase of severe weather, reaching a low point of 77 per cent of possible mileage performance in the latter month. The efficiency then increased gradually, despite gales of 70 m.p.h. in March, until it reached 98 per cent of the total possible mileage in May, 1919.

That the fogs, rain, snow and other climatic conditions are responsible for increased gasoline consumption and reduction of the number of miles traveled is clearly indicated by the chart, in which the curve showing the trips in clear weather, the miles traveled and the per cent of performance rise and fall together, while the trips in fogs, etc., the miles per gallon gasoline consumed, the cost of service and the forced landings rise and fall in direct contrast to the curve of the per cent of performance. Fifty-three of the trips made in January were through fog, rain and snow, at which time the mileage



Relation between mail carried and cost of service since May, 1918

performance fell to 82 per cent, while the cost of operation climbed to $13,300.

That the engine trouble was probably the result of climatic conditions to an important extent is indicated by the fact that it occurred chiefly at the same time with the forced landings caused by the weather.

Three types of airplanes have been used in the service, including the Standard, JNRI, the Curtiss and the De Haviland 4 army airplane, which was reconstructed and adapted to mail carrying. Each of the first two was equipped with engines of 150 hp. and the De Haviland with the 400 hp. Liberty engine. The reports indicate that the power of the Liberty engine was found necessary to combat the heavy gales. The 150 hp. engines were unable to achieve a speed over 37 m.p.h. in the face of the high winds.

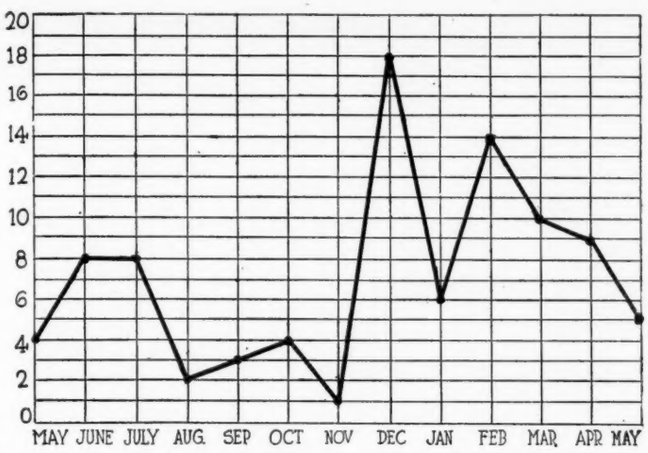
Of 1261 possible trips, 1206 were undertaken and fifty-five were defaulted because of weather conditions. Four hundred and thirty-five trips were made successfully during rain, fog, snow, gales and electrical storms. Fifty-one forced landings resulted on account of the weather and thirty-seven because of engine trouble. The Department believes that these forced landings have demonstrated that the airplanes, as designed for the army, lacked the strength necessary for daily cross-country work.

It was necessary early in the operation of the service to determine if visibility is essential to commercial flying. The first step was the refinement of the existing radio direction finders to eliminate the liability of 3 to 5 per cent of air. This was worked out by the Navy Department on an air mail testing plane. The second problem was that of guiding the mail plane to the center of the plot for landing. This problem has been solved by the Bureau of Standards in experiments with the radio directional compass, which is now effective to an altitude of 1500 ft. and by further refinements will be made efficient for 2500 ft. The year's flying in the mail service has established the fact that 200 ft. visibility from the ground is the limit of practical flying, although in emergencies flights have been made at altitudes as low as 50 ft.

Forced Landings Due to Mechanical Troubles, May 15, 1918, to May 15, 1919.

Date	Distributer	Magneto	Generator	Radiator or Water Trouble	Bad Valves	Gas Pressure Leak	Oil Pressure Leak	Carburetor	Plugs Fouling
May 16									1
May 20		1							
June 3	1								
June 8				1					
June 11				1					
June 24		1							
July 5									1
July 8									1
July 16							1		
July 23						1			
Aug. 27								1	
Sept. 21					1				
Sept. 24				1					
Oct. 26							1		
Oct. 30				1					
Nov., none									
Dec. 11		1		1					
Dec. 18*									
Dec. 19									1
Dec. 23							1		1
Dec. 24									1
Jan. 16							1		
Feb. 8				1					
Feb. 12							1		
Feb. 15			1				1		
Feb. 25							1		
Feb. 27					1				
Mar. 15				1					
Mar 21								1	
Mar. 25		1							
Mar. 27									2
Apr. 1				1					
Apr. 12						1			
May 2		1							
Totals									

*Thrust rod broke crank case; killed motor.



Number of forced landings due to weather and engine trouble

The distance between Washington and New York by air is 218 miles and has been covered in 1 hr. 58 min., while the distance between New York and Philadelphia, which is 90 miles, has been covered in 48 min. Speed averages have reached as high as 110 m.p.h., while against the severe gales of last March they were held down as low as 51 m.p.h.

Several of the planes, of the Curtiss and Standard makes, have records of 200 flying hours and 14,000 miles of flying each. Records of flight include 191 legs of the New York-Washington route by Dana De Hart, who covered 21,360 miles and made 179 of the legs and 20,324 miles without a forced landing. Max Miller flew 82 legs covering 9,242 miles without forced landing or an uncompleted flight. The service was under the control of army aviators during the first three months of operation, and was then taken over by the Post Office Department and was operated by a civilian organization.

Following is the complete report of Second Assistant Postmaster General Otto H. Praeger, who is in charge of the Air Mail Service, containing complete tables of the cost and the performance for the year:

Report on AIRPLANE MAIL SERVICE

Washington-Philadelphia-New York Route, for Year of May 1, 1918, to May 1, 1919

POST OFFICE DEPARTMENT,
Office of Second Assistant Postmaster General,
Washington, D. C., May 15, 1919.

The Postmaster General:

One year ago to-day the Aerial Mail Service was inaugurated by your direction, with instructions that once installed it must remain a permanent and practical feature of mail transportation. The first year's operation of this service has vindicated the judgment of the Department in entering upon this work.

At the request of the Chief Signal Officer of the Army, the operations of the Aerial Mail Service were originally conducted by the Army in connection with its work of training aviators for the war. This service continued under military direction until August 10, when, by agreement with the Secretary of War, it was taken over by the Post Office Department and operated by an entirely civilian organization.

A single route from Washington to New York was established, though much incidental work was done with reference to the extension of the service to other parts of the country as soon as sufficient equipment became available. This

Consolidated Statement of First Year's Operations of Air Mail Service

Month	Trips Possible	Trips Attempted	Trips Defaulted	Weather Encountered		Mileage Possible	Miles Traveled	Per Cent of Performance	Mails Carried (Pounds)	Cost of Service	Forced Landings Due to	
				Trips in Fog, Etc.	Trips Clear						Motor	Weather
1918												
May (15 days)	60	53	7	31	29	6,750	5,324	78.87	4,750	$3,682.11	2	2
June	100	96	4	35	65	11,250	10,685	94.97	13,081	9,922.71	4	4
July	108	106	2	41	67	12,150	11,855	97.57	16,967	10,001.46	4	4
August	109	109	0	17	92	11,988	11,984	99.96	16,588	9,555.67	1	1
September	100	100	0	36	64	10,900	10,900	100.00	15,200	9,638.74	2	1
October	108	108	0	24	84	11,772	11,617	98.68	16,788	9,841.76	2	0
November	104	102	2	24	80	11,336	11,118	98.07	16,854	10,673.68	0	1
December	104	91	13	50	54	10,896	8,415	77.23	17,778	13,300.46	7	11
1919												
January	108	92	16	53	55	11,772	9,653	82.00	18,105	13,741.58	1	5
February	97	92	5	42	55	10,554	9,307	88.18	15,489	13,645.16	6	8
March	106	102	4	34	70	11,554	10,699	92 59	17,531	13,880.29	5	5
April	107	105	2	32	75	11,682	11,105	95.06	16,677	13,516.44	2	7
May (15 days)	52	52	0	16	36	5,706	5,593	98.01	7,213	6,500.00	1	4
Total	1263	1208	55	435	826	138,310	128,255	92.73	193,021	$137,900.06	37	53

preparatory work related to the establishing of a second route from New York to Chicago, an air-line distance of 720 miles across the Allegheny Mountains and the southernmost points of Lakes Erie and Michigan

Trial flights were made to establish the practicability for commercial work of the De Haviland 4 airplane, which became available upon the signing of the armistice, but it was found that this plane, designed wholly for war purposes, lacked the strength necessary for daily cross-country work, with its incidental forced landings. It was then decided to modify these war planes, and, after some delay, aeronautical engineers have developed a strong and powerful plane which can still retain all the excellent flying qualities of the De Haviland machine.

The principal work of the Aerial Mail Service, however, concerned the operation of a daily air-mail service between Washington and New York, a distance of 218 miles air line. A great divergence of opinion existed among aeronautical experts as to the possibility of the Post Office Department keeping up anything approaching a daily service, regardless of weather conditions. The opinion was held that the service would have to be given up during the winter months. However, the postal authorities and the aeronautical experts retained by the Post Office Department believed that practically all of the weather conditions could be overcome, and that possibly 90 per cent of the trips scheduled could be entered upon. How well this judgment has been borne out is shown by the fact that out of a possible 1263 trips, only 55 were not undertaken and utterly failed on account of weather or other conditions requiring the sending of the mail by train. This is a record of only 4.4 per cent of trips not attempted. Out of a total 138,310 miles possible there were flown 128,255 miles, which is a performance of 92.73 per cent. Such performance for a single motor training plane was not believed possible when our service began, and has never been equalled in the history of aviation. It should be explained that the airplane journey from Washington to New York and return, daily, is made in four trips, as follows: Washington to Philadelphia; Philadelphia to New York; New York to Philadelphia, and Philadelphia to Washington, mail and—when necessary—pilots and planes being exchanged at Philadelphia.

In the year's operation an aggregate of 128,255 miles was flown, and an aggregate of 193,021 lb. of mail was carried, the cost of operation of this route being $137,900.06. It may be well to state here that the same six airplanes that entered upon this service a year ago to-day, with the same engines that operated them, are on the flying fields on this date, rendering a continuous service, and the mail to-day from Washington to New York and New York to Washington will be carried in the same airplanes that made the initial flight from Potomac Park on May 15, 1918, and that brought the mail from New York on that day. This operation has cast a new light on the question of the life of an airplane, and demonstrates that the mechanical requirements and results in commercial flying are much safer, much more economical, and in many instances more practical than in exhibition or military flying.

During the year there have been 37 forced landings, due to mechanical troubles during flight, which is another record not heretofore approached in aviation, and speaks well for American-built airplanes and the mechanics who were engaged to keep them in flying condition. Especially is this record a strong tribute to the American-built Liberty and Hispano-Suiza motors.

In field work, in testing out of planes by aviators, there has been one serious injury, when an aviator smashed a plane, resulting in the gas tank catching fire on the ground. In this accident the pilot was severely burned, but was able to report for duty at the end of four weeks.

The New York-Washington Air-Mail Service, while undertaken as a permanent transportation improvement in the carrying of mail, was, during its first year, largely an experimental proposition. Inaugurated before the close of the war, it was possible to obtain only small training planes with a limited capacity for carrying mail. It had to be established first that a daily, fairly dependable schedule could be maintained. Exploration and experiments had to be made to properly equip the planes to fly regardless of weather conditions and of visibility. The route was but 218 miles in length, and the cost of operations of this route had to bear the entire cost of adapting the war machines and training machines to commercial work as well as the cost of the experimental flying and the experimentation with devices that would enable flying in all kinds of weather. Under the circumstances, the cost of the service would naturally be higher than it should be the subsequent years of operation, with the expense problems connected with experimental flying solved. Likewise, the cost per pound of mail carried in the larger planes which are now available will be much less than the cost of carrying the mail in planes of but 200 lb. mail capacity.

Costs and Revenues

Revenue from airplane postage		$159,700
Saving in railway transportation		2,264
Total revenue and saving		161,964
Cost of operations	$137,900	
Loss, Standard Plane No. 3, less salvage of useful parts	4,961	
Total cost of operations		142,861
Surplus		$19,103

The consolidated cost sheet for the year shows the total cost of operations of the route to be $137,900.06, apportioned as follows: Cost per mile of overhead, $0.2829; cost per mile of flying, $0.2029; cost per mile of maintenance, $0.4081.

The revenue on the sale of airplane stamps was $159,700. In addition to the airplane mail there were carried several million ordinary letters taken from railroad connections,

which were advanced in delivery by airplane over train from twelve to eighteen hours. This improved service involved millions of letters delivered by reason of airplane service in New York in the afternoon, instead of on the following morning had they gone by train, which alone justifies from a postal standpoint the operations of the service.

The postal value of an airplane service depends upon the distance covered and upon railroad schedules. There is not sufficient business between New York and Washington of such an urgent nature as to pay out through airplane postage alone the cost of operations. The distance is too short and the train service too efficient to warrant the use on a large scale by commercial interests of airplane service in lieu of the train service. The transportation by airplane is ordinarily twice as fast as by train, and on distances of 600 miles or more, no matter how frequent or excellent the train service, the airplane mail at the higher rate of postage should equal the cost of its operation. Wherever the train service is not as frequent or as fast as it is between Washington and New York the airplane operations should show an immense profit on all distances from 500 miles up.

Again, with large airplanes and over greater distances, substantial reduction in the sums paid to railroads for mail transportation would be made, besides cutting down the time of transit by one-half.

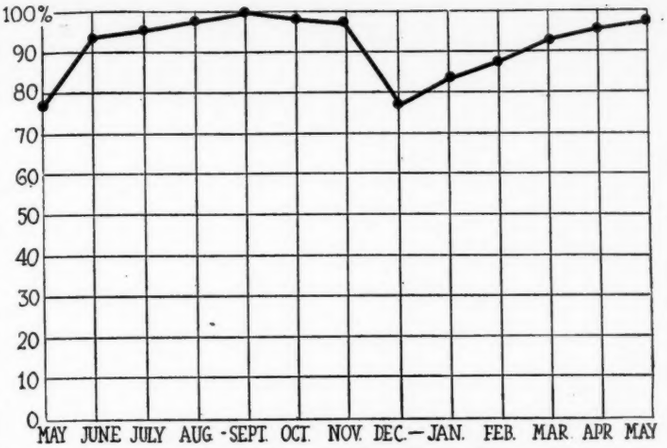
New York-Chicago Route Most Promising

The most promising of such routes is the run from New York to Chicago. An airplane leaving New York at 5 a. m., traveling at the rate of 80 m.p.h., with 15-min. stops for mail and exchange of planes at Bellefonte, Cleveland, and Bryan, will reach Chicago before 2 p. m., Chicago time, thereby insuring connection with the afternoon regular carrier delivery. Such an airplane dispatch, by reason of the great service rendered, would give a handsome profit on operations.

The first leg of the New York-Chicago route will be opened with our rebuilt De Haviland airplanes to-day from Cleveland to Chicago, and the remainder of the route from New York to Cleveland will be opened as soon as the necessary Curtiss R-4 mail ships are delivered to us by the factory, which should be within the next thirty or forty days.

One positive lesson learned from the operation of the aerial mail during the year is that the element of danger that existed in training aviators in military flying and exhibition flying is almost entirely absent from commercial flying.

The record of the Aerial Mail Service, which includes flying at altitudes of as low as 50 ft. in periods of marked invisibility, throws an interesting light on the dangers of aviation. In a period of one year, covering a travel of 128,255 miles, there has never been an airplane carrying the mail fallen out of the sky; there has not been a single death of an aviator in carrying the mails. The casualty record for the year comprises two deaths. One of these was in the case of an aviator who undertook to give a demonstration of his flying ability before being given a plane to carry the mail. He went up in a De Haviland 4 and showed by his management of the plane that he was not qualified for the work. He put the plane in a vertical stall at a low altitude and crashed to the ground, killing himself. The second casualty was that of a mechanic who slipped and fell into a whirling propeller of a machine that was on the ground.



Per cent of possible monthly mileage flown since May, 1918

There have been six injuries to aviators of a minor character and two serious enough to send the aviators to the hospital for a period of several weeks each. All of these accidents occurred, not in the air, but while on the ground. Of the minor injuries, the aviators were in a position to report for duty on their next run. These injuries consisted mainly of bruises or contusions sustained by a plane turning over after it had landed on the ground. Of the three types of planes operating regularly in the mail service, one type was more given than the others to turning over on rough ground, and it was principally on those planes that the pilots were shaken up or bruised by the plane turning turtle.

The first serious accident, which resulted in a hospital case

Consolidated Cost Sheet of First Year's Operations and Maintenance of the Air Mail Service

Airplane Number	Gas	Grease and Oil	Office Force	Motor Cycles, Trucks	Rent, Light, Fuel, Power, Telephone, and Water	Miscellaneous	Pilots	Mechanics and Helpers	Repairs and Accessories
1	$539.36	$105.71	$159.31	$178.55	$157.60	$335.70	$961.86	$782.36	$2,747.48
2	698.09	187.17	353.70	427.52	308.47	1,052.85	1,358.80	1,622.64	608.95
3	449.16	153.40	281.01	396.20	280.93	828.13	903.76	1,377.66	293.22
4	631.71	175.16	340.95	427.52	258.92	821.23	1,061.77	1,664.10	697.74
5	317.58	78.24	131.22	178.53	157.61	335.71	613.80	827.47	516.08
6	283.52	81.62	109.00	115.49	124.12	215.96	540.40	728.03	433.85
7	164.45	54.91	167.16	169.01	107.29	442.55	212.60	687.39	125.94
8	119.13	18.43	121.18	169.00	107.28	330.55	253.24	471.05	104.45
30	124.97	11.15	43.37	107.33	39.96	133.79	36.71	243.78	67.00
14872	129.93	20.43	49.30	91.41	66.93	217.06	91.51	389.31	18.35
24213	54.59	11.13	40.20	63.05	33.51	119.77	67.31	85.85	16.20
24224	30.15	6.24	22.32	107.33	27.95	122.25	17.66	31.72	12.00
37944	15.75	2.71	11.73	12.40	22.06	2.66	48.41	129.99	9.77
(10) 38262	704.21	207.80	376.88	618.20	319.57	954.62	1,230.57	1,891.86	2,360.18
(12) 38274	896.90	242.85	364.10	618.20	306.36	915.23	1,265.83	2,200.88	1,796.60
(17) 38275	698.47	202.49	394.69	618.20	363.12	1,113.22	1,076.10	2,075.00	2,269.61
38276	191.01	60.70	46.13	190.68	54.66	62.38	321.57	587.69	270.44
(11) 38278	1,063.82	328.49	407.98	618.20	376.16	1,031.78	1,832.37	2,748.31	713.73
(14) 38279	272.96	91.73	195.02	248.99	162.87	466.69	745.85	868.30	457.46
(15) 38280	283.70	57.22	167.16	169.00	106.68	448.56	544.13	715.53	275.37
(39) 39362	570.99	114.93	330.63	574.48	313.52	800.86	545.90	1,689.93	1,803.17
(38) 39363	710.47	117.06	265.34	574.49	248.26	808.83	740.02	1,500.87	341.43
39364	221.66	47.80	181.83	412.94	225.56	905.11	339.76	910.94	339.18
39365	581.83	72.29	257.94	593.91	315.76	930.66	566.50	1,422.15	288.27
39366	503.12	69.62	124.93	285.06	127.74	243.43	511.81	822.50	667.25
(43) 39367	534.45	49.14	179.17	416.88	200.11	502.51	579.25	1,160.72	968.85
Totals	$10,791.98	$2,568.42	$5,122.25	$8,382.57	$4,813.00	$14,142.09	$16,467.49	$27,636.03	$18,202.57

Cost per mile overhead, $0.2829; cost per mile flying, $0.2029; cost per mile maintenance, $0.4081.

NOTE.—The numbers in column 1 in parentheses indicate new numbers of planes.

Consolidated Cost Sheet of First Year's Operations and Maintenance of the Air Mail Service

Airplane Number	Interest on Investment	Departmental Overhead Charge	Total	Service and Unit Cost						
				Gallons of Gas	Total Time Run		Total Miles Run	Miles Run per Gallon of Gas	Cost per Hour	Cost per Mile
					Hours	Minutes				
1	$401.77	$422.48	$6,792.18	1,826	127	29	10,253	5.61	$53.40	$0.6624
2	685.51	746.68	8,050.38	2,282	151	06	11,547	5.06	53.40	.6971
3	583.54	633.19	6,180.20	1,507	85	40	6,413	4.25	72.00	.9636
4	685.51	746.68	7,511.29	2,063	137	54	9,993	4.84	54.60	.7516
5	401.79	422.47	3,980.50	1,082	78	46	4,389	4.05	50.40	.9069
6	331.67	337.16	3,300.82	935	61	49	4,944	5.28	53.40	.6676
7	186.39	184.05	2,501.74	540	21	08	1,643	3.04	70.80	1.5226
8	186.39	184.05	2,064.75	391	18	14	968	2.47	113.40	2.1330
30	131.35	118.97	1,058.38	414	3	07	180	.43	339.60	5.8798
14872	144.90	168.53	1,387.66	412	10	39	962	2.33	130.20	1.4424
24213	70.11	85.31	647.03	174	7	51	476	2.73	82.20	1.3593
24224	108.46	118.97	605.05	100	1	50	180	1.80	330.00	3.3613
37944	27.56	16.66	299.70	62	7	19	550	8.87	40.80	.5449
(10) 38262	828.14	850.44	10,342.47	2,291	157	06	10,273	4.48	66.00	1.0066
(12) 38274	828.14	850.44	10,285.53	2,939	219	.....	14,393	4.89	46.80	.7146
(17) 38275	828.15	850.42	10,489.47	2,287	150	53	9,840½	4.30	69.60	1.0659
38276	163.92	103.78	2,052.96	632	51	34	3,401	5.38	39.60	.6036
(11) 38278	828.16	850.44	10,799.44	4,151	252	49	17,953	4.32	42.60	.6015
(14) 38279	262.47	324.21	4,096.55	877	61	10	4,380	4.99	67.20	.9352
(15) 38280	165.14	184.04	3,116.53	921	52	36	3,951	4.28	59.40	.7887
(39) 39362	725.29	720.28	8,189.98	1,826	49	33	3,988	2.18	165.00	2.0536
(38) 39363	725.27	720.29	6,752.33	2,219	73	08	6,161	2.77	92.40	1.0959
39364	583.74	579.69	4,748.21	774½	25	28	1,907	2.46	186.00	2.4898
39365	774.69	788.94	6,592.94	1,749	61	31	5,132	2.93	107.40	1.2846
39366	336.01	302.57	3,994.04	1,672½	90	35	8,098	4.84	43.80	.4932
(43) 39367	520.29	448.56	5,559.93	1,803	61	51	5,006	2.77	90.00	1.1106
Totals	$11,514.36	$11,759.30	$131,400.06	35,930	2020	06	146,981½	4.09	$64.80	$0.8939
	Add May 1 to 15, 1919		6,500.00	.....	76	14	5,593	.....	.....	.....
	GRAND TOTALS		$137,900.06	.....	2096	20	152,574½	.....	.....	.....

of several weeks, occurred to a pilot driving a De Haviland 4, the axle of which crumpled after the pilot had touched the ground and had run some distance along the surface.

The other accident was in the case of an aviator who started up to try a motor that had gone through the block test, and at 150 ft. elevation it began to miss. Not desiring to take the chance of landing on rough ground, he undertook, what nobody has ever been able to accomplish with a De Haviland, that is, to turn around and land in the center of his field. The turn naturally killed his speed and he slipped to the ground in a side slip. The plane struck partially on a wing and partially on the radiator nose, driving the engine into the air-pressure tank, which squirted a spray of gasoline that caught from the exhaust and sent the machine in flames while the plane was on the ground. The aviator jumped through that flame and his clothing caught fire and he was burned about the face and hands.

One Death for Every 64,108 Miles Flown

Of one type of machine in the mail service, which has performed almost half of the amount of work of the other two types, there has never been a case, by reason of the construction of the machine, of turning turtle. This record means, taking into account all of the accidents, whether on the ground, testing machines, testing aviators, flying the mail, or other cross-country work, that there has been but one death for each 64,018 miles flown—one serious accident in each 64,018 miles, and one minor hurt for each 21,340 miles. This is a record which will compare favorably with any mode of mechanical transportation in its early days. Even this favorable record is susceptible to improvement by reason of the steady development of the airplane itself.

The following is a chronological list of accidents and deaths in the Aerial Mail Service for the year just past:

Sept. 10, 1918—Ed. C. Radel, mechanic, plane No. 39367; turned over and completely wrecked on return experimental trip from Chicago to New York; Radel pinned under plane; motor fell on him, injuring arm somewhat, and burning back with gasoline; 10 miles from Belmont; taken to hospital for treatment, but out next day. Edw. Gardner, pilot (Chicago-New York reconnoissance); nose had been broken a short time before; this fall shook it loose again and gave him a black eye.

Oct. 18, 1918—M. A. Newton, pilot, plane No. 39366, Philadelphia to Belmont; four miles from Belmont engine went dead, gas pressure failed, and dropped plane in deep hole which was so covered with dust and weed-filled that it looked to be solid ground; thrust pilot forward, breaking his nose; flew next day.

Dec. 16, 1918—Carl B. Smith, pilot, making demonstration flight to show ability to fly; plane No. 39464, DH-4; machine in perfect condition according to test-out before; Elizabeth, N. J.; plane fell directly to earth, killing pilot instantly; observation made that if pilot's seat had been in the rear cockpit where the mail compartment was he might have been saved, as that part of the plane was undamaged; pilot crushed almost beyond recognition.

Dec. 28, 1918—Lyman W. Doty, pilot, injured in accident at Belmont Park; plane No. 24238, DH-4, demolished; faulty axle; machine of too soft wood; crumpled like an eggshell when the axle of the plane gave way; this pilot would not have been injured if pilot's seat had been located in the rear where the mail chute is placed instead of directly between the engine and gas tank.

Jan. 7, 1919—Auguste Thiele, mechanic, while starting propeller of plane No. 4, slipped and fell in front of blade, fracturing skull, at Belmont Park; accident occurred at 3.20 p. m.; Thiele in hospital at 4.40 p. m.; died at 6.14 p. m.

March 19, 1919—L. D. Smith, pilot, plane No. 8, Tottenville, Staten Island, N. Y.; Smith's nose broken; heavy wind brought him down; nothing wrong with motor; broke landing gear, propeller, and wing.

April 26, 1919—Paul Ferron, plane No. 68, DH-4, Belmont; pilot started up to try a motor which had gone through the block test, but it missed at 150 ft. Not desiring to land on rough ground, he turned around to land in the center of the field, killing his speed and slipping to the ground in a side slip; plane struck partly on wing and partly on radiator nose, driving engine into air-pressure tank, which squirted a spray of gasoline that caught fire from the exhaust and sent the machine in flames; pilot jumped through flames clothing catching fire, and receiving burns about face and hands; in hospital several weeks.

In the course of the year a number of severe gales were encountered and a few trips failed through experimenting with different types of planes to meet the gale conditions. Out of the experience this lesson was learned: It is useless to send

(*Continued on page* 1147)

Design of Tractor Wheels

Variety in Design Emphasized by Sketches Shown—Spokes Made of Round and Flat Bar Stock and of Pressed Steel—Plain, Flanged and Corrugated Rims

By P. M. Heldt

TRACTION engine wheels have been in use for many decades, and it might be supposed that their design had been fairly well settled. This, however, is far from correct. It must be remembered that previous to the advent of the gas tractor the number of traction engines manufactured was limited and there was not that competition among parts makers to improve their product, and thus secure for themselves a bigger share of the market, which we are witnessing to-day. All improvement in wheels tends toward decrease in weight without loss of strength and toward a lessening of the cost of manufacture.

Tractor wheels must, of necessity, have comparatively large diameter, and this seems to almost preclude the all-cast wheel. The rims are rolled of either flat or angle steel, the hubs are cast and the spokes, which are of either flat or round section, are riveted to the rim and either cast into the hub or riveted to flanges thereon. All wheels have two rows of spokes, and in order to secure lateral rigidity these spokes must slant considerably. The driving and braking torque is not transmitted through the spokes, and the latter therefore may be arranged radially.

The sketches illustrating this article were drawn by an AUTOMOTIVE INDUSTRIES artist at the Kansas City tractor show and represent practically all the different designs of wheels at present in use. One of the sketches shows the Fordson front wheel. The rim of this wheel is rolled up out of two steel angles, and the flat spokes are riveted between the two outwardly extending flanges of the angles which form the skid ring. The outer ends of all spokes are thus in the same plane, and this gives considerable inclination to the spokes, insuring great lateral rigidity without an unduly long hub. The inner ends of the spokes are cast into the hub.

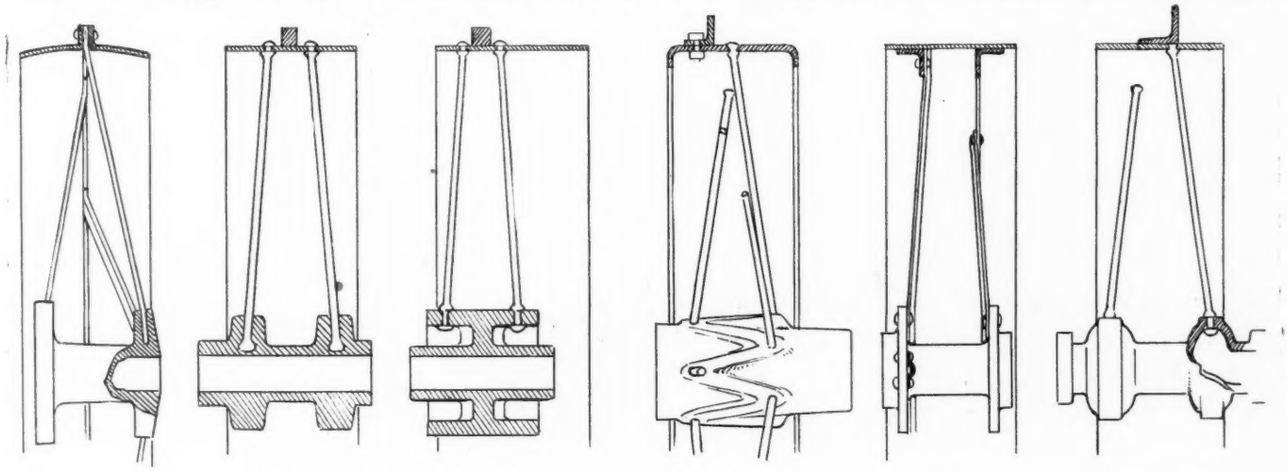
Two other designs are by French & Hecht, and are standard traction engine wheels. Both have plain rims, and the round spokes are cast into the hub, being anchored in circumferential flanges in one instance and in a sort of rim in the other. It does not appear that there is much difference between these two designs of hubs as regards weight of metal. Plain skid rings of square cross-section are shrunk on to these wheels.

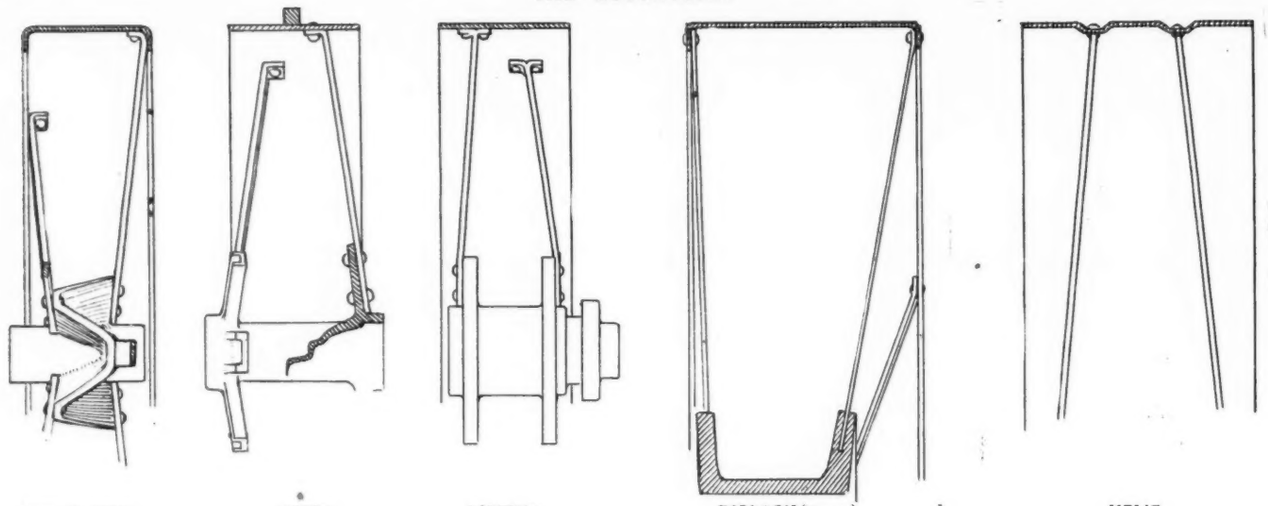
Another sketch shows the Hart-Parr design of front wheel. This has an inwardly flanged rim, a construction which gives light weight without unduly reducing the structural strength. The sketch bears witness to the effort of the designer to reduce weight to a minimum. In order to gain plenty of lateral strength, the spokes are all brought to the same central line on the rim, and are given a considerable slant. To secure a firm anchorage of the spokes in the hub, the latter is cast with a zigzag flange, the spokes entering the hub at the turning points of the flange. In this wheel an angle-iron skid ring is used, which is bolted to the rim.

The J. I. Case T. M. Co. wheel has a plain rim with two angle-iron rings riveted to the inside, to which the spokes are riveted. The spokes are made of pressed steel, with a corrugation running down the middle, and appear to be very light. This is the first sketch to be shown in which the spokes are riveted both to the rim and to the hub. There are flanges of ample depth on the hub, which facilitate the riveting.

The Russel front wheel has round spokes cast into the hub and riveted into the plain rim. An angle-iron band serves as a skid ring. The hub is somewhat unusual, in that it is chambered out where the flanges for the spokes come.

The wheel of the new Twin City tractor has the hub formed with a moderately deep zigzag flange, with flats at the turning points, to which the spokes are riveted. The advantage of this construction is that it is much





easier to hold the heads of the rivets in riveting the spokes in place than where there are two flanges. As the two rows of spokes are comparatively close together at the hub, they are arranged to spread outwardly toward the rim, and they are riveted to the rim just inside the inwardly turned flange. The Avery front wheel has a cast hub with spurs to which the flat spokes are riveted. The spurs are quite long, and are formed with a depression, in which the flat spokes fit, and there are two rivets in each spur.

The wheel of the Liberty tractor has flat spokes with Tee heads riveted to the rim, and a cast hub with deep flanges to which the spokes are riveted on the outside. There are two rivets through the inner end of each spoke.

The Fordson rear wheel is similar to the Fordson front wheel, except that the two rows of spokes, instead of approaching, recede from each other in passing from the hub to the rim, and the outer ends are riveted to the inturned flange of the wheel rim.

The rear wheels on the new Velie tractor have corrugated rims. The wheels are of French & Hecht make, and the idea of the corrugation is to strengthen the rim.

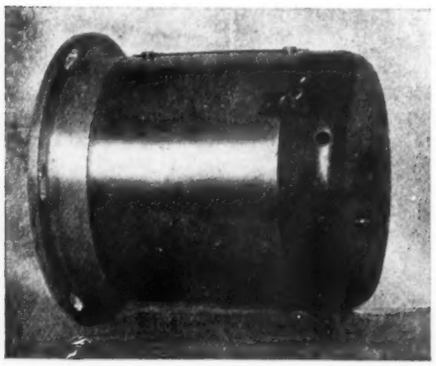
The Liberty Ignition Magneto

ENGINEERS of the Berkshire Magneto Co., Pittsfield, Mass., have developed a high tension, inductor type magneto which is mechanically interchangeable with the distributor heads forming part of the battery ignition system used on the Liberty aircraft engine. This magneto will be marketed as the Liberty.

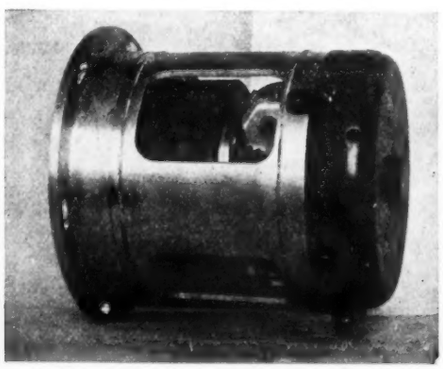
In appearance the magneto closely resembles a small electric motor, as it is cylindrical in form, measuring 6½ in. in diameter by 7¾ in. in length. The weight is less than 17 lb. Briefly described, the magneto consists of a cylindrical aluminum frame within which is mounted an aluminum field casting with four sets of laminated steel inserts for pole pieces. The four poles of the field are not symmetrically arranged, as in standard practice, but are located so that the distances between the centers of adjacent poles are alternately 67½ and 112½ deg. apart, these angular spacings corresponding to the intervals between successive explosions in the engines. This arrangement insures that all sparks occur at corresponding points of the voltage wave, thus insuring substantially equal intensity of all sparks.

Secured to opposite sides of the field casting are two nearly semicircular magnets of tungsten steel, the ends of which abut each other in the center of one pair of pole shoes. The primary and secondary coils of enamel-insulated wire are wound on a laminated core. After final assembly the entire unit is thoroughly impregnated with a special compound in a vacuum.

A two pole rotor, arranged for four sparks per revolution, built up of steel punchings and assembled on a one-piece, hollow steel shaft, is carried on two substantial ball bearings,

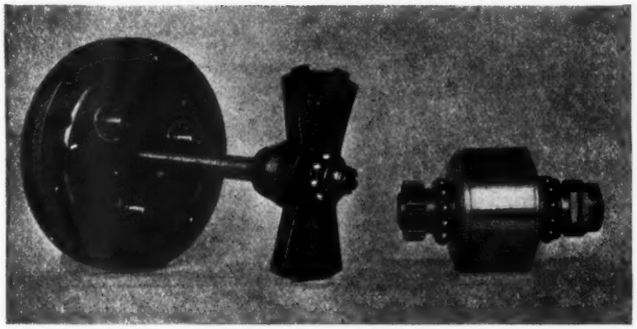


Complete Liberty magneto

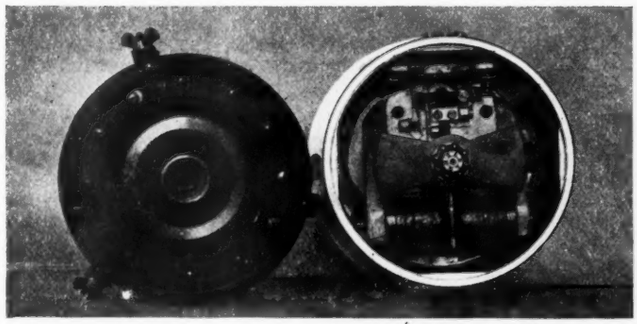


Magneto with sheet metal housing removed

Arrangement of field structure



Distributor and distributor gearing



End view of Liberty magneto showing interrupter and cam

one of which is rigidly mounted in a flange on the inside of the main frame, while the other is pressed into an aluminum plate, secured to the outer end of the field casting, which also serves to carry the interrupter and condenser.

The interrupter, which is of exceptionally light design, is operated by a self-lubricating cam, so designed as to provide for the irregular spacing of explosions.

The distributer is of the gap type, made of a molded compound, with metal inserts and socket type, radial receptacles for the leads from the spark plugs, the terminal binding screws being on the inside. This distributor also serves as the end cover of the magneto, and when removed exposes the interrupter, condenser, coil and other vital parts, which are thus easily accessible for inspection or repair.

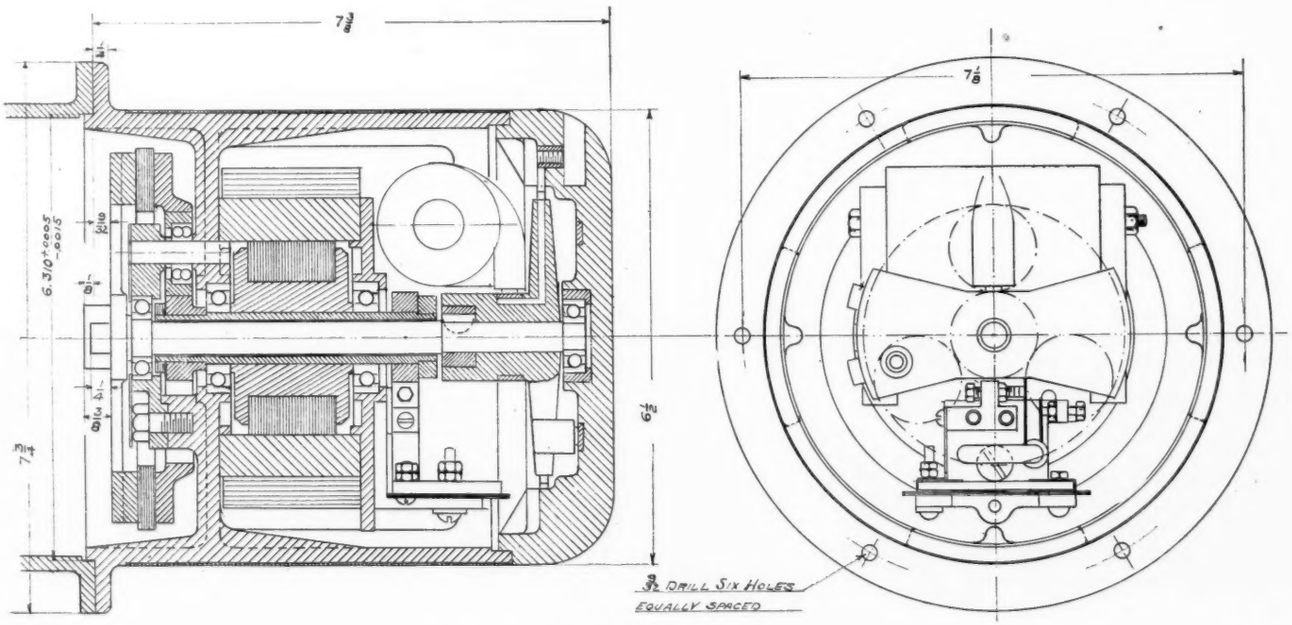
Power is transmitted from the camshaft of the engine to the rotor through a flexibly mounted train of gears, comprising a large bronze annular gear and three steel pinions, which latter engage with a hardened steel pinion on the rotor shaft, causing it to turn at three times camshaft speed. A sheet metal cover incloses the side of the frame and together with the distributor on the end forms a water and dust proof protection for the working parts of the magneto.

Newest Type of Zeppelin Cruiser

ALL the latest improvements that the Germans had achieved were embodied in a Zeppelin which made a forced landing in France in October, 1917. Since that time no change has taken place in any essential feature. In length the airship is about 656 ft., the total height 79 ft., and its volume 2,000,000 cu. ft. In form the central portion is cylindrical, and the two ends taper to a cone. Of the four gondolas one is placed well forward. This is divided into two compartments, in one of which there is the commander's cabin and the wireless telegraphic apparatus, while in the other the motor is fixed. Approximately amidships, side by side, are two other gondolas, each of which is also furnished with a motor. The fourth gondola, situated close to the tail, contains two engines, one of which is held in reserve for emergencies.

A triangular passage is built into the lower part of the envelope and is completely covered in. A ladder connects the gondolas directly to this passage. A wooden construction in the center of this passage contains the fuel, the water ballast, the bombs, and several hammocks. A cylindrical chimney, constructed of a series of metal rings, connects this passage to a platform on the top side of the airship, where machine-guns and other light weapons are stationed. The four gondolas are well streamlined. The most forward of these is 32.8 ft. long, 20 ft. of which is taken up by the cabin of the commander. In height this chamber is 8.2 ft. and in breadth 7.4 ft. The motors develop approximately 1200 hp., while the diameter of the four propellers is 16 ft. The fuel tanks are of aluminum, and hold 80 gal.

The water ballast tanks have a capacity of 265 gal. The normal speed of this airship amounts to 62 m. p. h., while journeys of 30 hours' duration were undertaken without any difficulty. With a good climbing capacity the airship can attain heights of 18,000 to 20,000 ft.



Sectional and end views of Liberty magneto

Flowmeters and the Calibration of Carbureter Nozzles*

Experimental Work on Carbureter Nozzles in Respect to Gasoline-Flow Calibration—Development of a Standard System of Carbureter Nozzle Calibration by Gasoline Flow

By Capt. G. Smith Clarke

PREVIOUS to July, 1915, as far as the author is aware, it was the universal practice of carbureter manufacturers to define the size of their carbureter nozzles as the size, in inches or millimeters, of the drill used to produce the orifice. This system, however, did not give that interchangeability of the nozzles, from a carburetion standpoint, which it was undoubtedly intended to do. For instance, let us suppose that an engine fitted with a duplex carbureter was giving satisfactory results when two nozzles marked 1.70 mm. were fitted. There was then absolutely no guarantee that another engine and carbureter, similar in every respect as far as is possible, would give anything like similar results when fitted with two other nozzles also marked 1.70 mm.; or, further, let us again suppose that such an engine when fitted with nozzles marked 1.70 mm. showed obvious signs of weak mixture, then again there was no guarantee that nozzles marked 1.80 mm. would pass more gasoline; in fact, as will be shown later, it was frequently found that nozzles marked 1.60 mm. passed more gasoline than those marked 1.80 mm. when tested under similar pressures. This condition of affairs created the impression that there was some mysterious "individuality" among gasoline engines, even when they were practically identical in capacity, design and workmanship. Subsequent developments have proved that much time, labor and materials were needlessly expended in trying to cope with this supposed "individuality," which in the majority of cases was really due to the "individuality" of the carbureter nozzles.

It is believed that the first investigations into the behavior of carbureter nozzles as commercially manufactured were carried out by Lieut. B. Humphrey, who, about 1905, when assistant manager of the Great Western Railway Motor Car Department, instituted a system of nozzle calibration by gasoline flow.

The apparatus first used is shown in Fig. 1, and consisted of a length of ½-in. gage glass tube, to one end of which was fitted an adapter to take the carbureter nozzle to be calibrated. At two points, as shown on the diagram, datum lines were made on the tube, 10 in. apart, and the number given to the nozzle was the number of seconds required to pass the quantity of gasoline between these points.

The method of using this instrument was for the operator to hold the tube vertically, nozzle downward, and, closing the nozzle orifice with his finger, to fill the glass tube with gasoline; the nozzle orifice was then uncovered, and as the top of the gasoline column passed the first datum point a watch was started, being stopped as the column passed the bottom datum point. Such a method was obviously crude and liable to serious error, but the results obtained were such as to fully justify the development of the system, and it may be stated that from the date of these early experiments until the present day the size of all nozzles used by the Great Western Railway Motor Car Department has always been designated by a figure representing discharge under fixed conditions. In 1909-10 it was decided to standardize a system whereby all nozzles were calibrated under a constant head of 100 cm., the number stamped upon the nozzles representing the quantity of gasoline in cubic centimeters passed in unit time, which was fixed at one minute.

The instrument used for this system of calibration consisted of a 1-in. brass tube a little over 100 cm. in length, fitted at the lower end with an adapter to take the nozzles to be calibrated, and provided with a valve to control the flow of gasoline. At the upper end a float feed mechanism was fitted, which maintained a constant level of gasoline in the tube 100 cm. above the nozzle orifice. This, it is confidently believed, was the father of all constant-head nozzle calibrating machines, and upon this system has been based the system now standardized by the Aeronautical Inspection Department and the Royal Air Force.

Concurrently with the nozzle calibration experimental work described, efforts were made to produce a simple gasoline flowmeter for the determination of the gasoline being consumed during engine testing. The usual method of measuring consumption by timing a given volume of gasoline is liable to serious error, its accuracy depending entirely upon the personal element, while to run one hour or even half hour consumption tests is wasteful and expensive. After much experimental work and many failures, a satisfactory instrument was evolved. This will be fully described later.

In July, 1915, when the author first became interested in

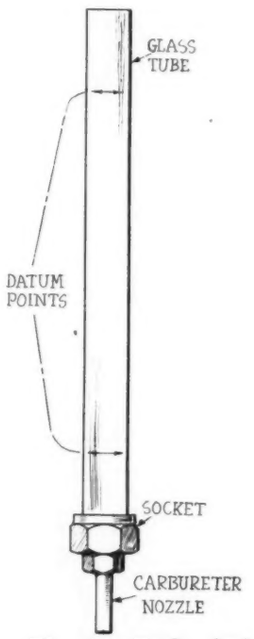


Fig. 1—Early device for determining flow characteristics of carbureter nozzles

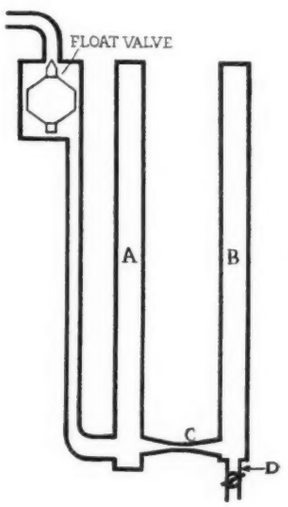


Fig. 3—Diagram of flowmeter type of instrument

*Paper presented to the Institution of Automobile Engineers, condensed.

the inspection and running tests of aero engines, the 80-hp. Gnome and the 90-hp. R. A. F. were the engines built, both being air-cooled and therefore very sensitive to variations in the strength of the explosive mixture. The Gnome engine was fitted with a floatless carbureter having a multi-orifice nozzle, the actual gasoline flow being controlled by a simple stopcock between the nozzle and the fuel supply. As may be supposed, very careful adjustment of the stopcock was needed to get the engines through their tests, on the fuel consumption demanded, without damage to the steel cylinders through overheating, and it was quite the usual thing for an engine to do several official test runs before the tester hit upon the correct adjustment.

The 90-hp. R. A. F. engine was fitted with a duplex carbureter having two diffuser nozzles, and it was a very difficult job to get these engines through the official test, one engine often taking several days. The troubles experienced were overheating, failure to obtain the required fuel consumption, erratic running and bad distribution. These troubles were usually attributed by the manufacturer's staff to insufficient cooling, and to "dud" magnetos, but it was always the opinion of the author that the great majority of them were due to bad carburetion. Reaming of nozzles was officially prohibited, since it was obvious that the nozzles must be interchangeable in the field by makers' numbers; after changing nozzles it was necessary to run the engine for at least half an hour before the result could be seen, and if, as frequently happened, the engine during the run had been getting a weak mixture, overheating had dried up the pistons and damaged the piston rings, which would not be detected until several tests had been run, the engine getting steadily worse and finally refusing to give the required power. It would then be taken off the test bed and overhauled, after which the whole process would be repeated, until by a lucky shot a pair of nozzles were found which gave the required results, and the engine was passed off test amid general rejoicings.

Irregularities in Operation Traced to Nozzle Sizes

Finally the conclusion was reached that carburetion was really the root of the trouble, and investigations were made into the characteristics of the carbureter nozzles as supplied by the manufacturers. Tests carried out with a small tank, a glass measure and a stopwatch showed that it was quite impossible to take the maker's number as an indication of the quantity of gasoline which the nozzle would pass under given conditions. As the result of these investigations, an instrument was made for the calibration of nozzles under a constant head. The instrument previously described was copied, except in the matter of the actual head used. This, in view of the fact that the nozzles used in the aero engines were very much larger than those used in car engines, and also that the instrument might be reduced in size, was fixed at 50 cm. The timing mechanism was incorporated as an integral part of the instrument and inter-connected with the control valve.

A large number of jets of various makers' sizes were then taken from the stock of an engine contractor, and these were very carefully calibrated; the new number, which represented quantity of gasoline in cubic centimeters per minute passed under a constant head of 50 cm. was tabulated against the original maker's number, the results of these experiments being shown in Tables I and II.

These figures confirmed the previous conclusion that the maker's number had practically no connection with the actual nozzle size, and it was decided that all nozzles in stock at the works of various engine contractors must be recalibrated, but as the engine testers and the R. F. C. personnel were accustomed to think of nozzles in maker's numbers, it was at this juncture decided that such numbers must be retained, a flow of value being fixed for each nominal size.

Time instruments were installed at the works of the carbureter makers, and nozzles began to come through which could be depended upon to some extent. The result of this was that conditions in the engine-testing shops showed great improvement, and engines were got through acceptance tests with very much less trouble. A little later, upon the introduction of other makes of carbureters, it was finally decided to drop drill sizes entirely and to adopt the gasoline flow figure as the nozzle size. This was known as A. I. D. Standard Jet Calibration System, Mark 1, the sizes indicating the flow of gasoline through the nozzle in cubic centimeters per minute, under a constant head of 50 cm., using gasoline of S. G. 0.700 to 0.750, at a temperature of 50 deg. F.

Nozzle Calibration Eliminates Carbureter Tuning

With every type of engine using non-adjustable nozzles, it has been possible to fix the nozzle sizes for use on test and in flight, and with very few exceptions all the engines of any one type have been tested upon nozzles of the fixed size without any carbureter tuning whatever, while in the very few exceptional cases the necessary change has not exceeded plus or minus 15 per cent, the extreme variation only being found in the case of nozzles of the diffuser type.

All engines have been dispatched from maker's works fitted with the standard size flight nozzle for its particular type, and in this case again, with very few exceptions, the machines have passed the flight test, and have been put into service without alteration of nozzle size.

In the comparatively few cases where it has been necessary to change the flight size nozzles this has usually been eventually traced to variations in the design or position of the air intake pipes fitted after the engine has been installed in the aeroplane.

In the case of rotary engines having carbureters fitted with adjustable nozzles, a very interesting instance of the value of "gasoline flow" calibration has been experienced. On what is believed to be the most powerful rotary engine which has been built in quantities, a carbureter was fitted in which the nozzle size was controlled by a taper needle connected to the throttle slide; this had been adapted from a smaller edition of a similar type of carbureter, and the needle valve was very far from satisfactory. Once a carbureter was corrected to suit the engine all other carbureters were

TABLE I

Maker's Number	Flow in c.cs. per min.	Maker's Number	Flow in c.cs. per min.	Maker's Number	Flow in c.cs. per min.
1.60	255	1.65	250	1.70	280
1.60	215	1.65	270	1.70	277
1.60	195	1.65	240	1.70	257
1.60	197	1.65	260	1.70	257
1.60	252	1.65	230	1.70	290
1.60	275	1.65	267	1.70	290
1.60	240	1.65	255	1.70	240
1.60	257	1.65	260	1.70	245
1.60	257	1.65	265	1.70	255
1.60	232	1.65	260	1.70	280
1.60	240	1.65	*100	1.70	287
1.60	210	1.65	265	1.70	277

TABLE II

Maker's Number	Flow in c.cs. per min.	Maker's Number	Flow in c.cs. per min.	Maker's Number	Flow in c.cs. per min.
1.75	285	1.80	280	1.85	280
1.75	260	1.80	282	1.85	292
1.75	257	1.80	270	1.85	267
1.75	257	1.80	262	1.85	272
1.75	245	1.80	272	1.85	290
1.75	277	1.80	292	1.85	297
1.75	170	1.80	267	1.85	280
1.75	287	1.80	287	1.85	245
1.75	265	1.80	282	1.85	292
1.75	272	1.80	282	1.85	282
1.75	270	1.80	277	1.85	280
1.75	280	1.80	300	1.85	272

*Obstructed by solder inside nozzle tube.

made uniform and interchangeable with it, by calibrating each one on a specially adapted flowmeter, at several positions of throttle opening. So satisfactory was this method that when shortage of carbureters rendered this necessary engines were despatched without carbureters, to be followed when supplies permitted by carbureters which had been calibrated, but which had not been tested upon engines, and in every case these functioned correctly when fitted to the engine, without any further adjustment whatever.

Standard System of Nozzle Calibration

With the adoption of the principle of gasoline flow calibration, and the decision that all nozzles must be calibrated on the "time instrument," new troubles were at first experienced, it being frequently found that nozzles calibrated in London failed to check up correctly when tested at Coventry or Birmingham. Many theories were put forward to account for these discrepancies, the most usual ones being that temperature and barometric pressure were affecting the accuracy. The author, while recognizing that temperature was possibly having some small effect, could not believe that this factor alone was responsible for the amazing differences sometimes found between a nozzle calibrated at the maker's works and the same nozzle when tested upon his master instrument at Coventry.

Causes for Test Differences

Investigations were made by taking nozzles which had been very carefully calibrated at Coventry and trying them in the instruments in use in London, and, strangely enough, the London figures were identical in every case with those obtained at Coventry. This was very puzzling, but finally the trouble was located, and found to be caused by three things, among which the factors of temperature or barometric pressure were *not* evident.

The first and most important cause of the differences was that the calibrating instruments used by makers did not have interconnected stopwatches, an ordinary 30-minute recorder, constantly working, being hung between two instruments, and doing duty for both. It was found that in order to save time the operators did not always start gasoline flow when the hand passed zero on the watch dial, but at the point which the hand happened to be passing when the nozzle was in position ready for calibrating, and as the operators naturally talked with each other while waiting for the minute to pass, it was very likely that in many cases calibration commenced at, say, 10 seconds past zero, and continued for perhaps 50 seconds, or perhaps 70 seconds, the operator, in the meantime, having forgotten just where she began.

The second cause of difference was that the particular nozzles in question, being of the diffuser type, had a cap screw, which, during the calibrating process, was left loose in order to facilitate its removal by the fingers when it was necessary to ream the orifice to size. When this cap was finally screwed hard home it then occupied a different position, and was closer to the nozzle orifice than it had been during calibrating, and this was found to vary the flow when again tested in the instrument by some 8 to 10 per cent.

The third cause of difference was that the cap screw mentioned was, after final assembly, locked by soldering, and it would seem that either the soldering fluid used or the heat had some considerable influence on the nozzle orifice, this being proved by the fact that nozzles calibrated immediately before and after soldering showed marked differences in discharge.

Three Master Instruments Provided

To settle disputes as to the accuracy of calibration figures, three master instruments were provided, which it was claimed were absolutely accurate and foolproof. These were designed by a London automobile engineer, the principle being that the opening and closing of the gasoline valve was automatically accomplished at an interval of exactly one minute. The energy was provided by a falling weight, and the time controlled by a quarter-seconds pendulum. Unfortunately, although the design was undoubtedly very ingenious, it did not work properly, and after much heartbreaking work it was finally decided to discard the automatic gear and to substitute an interconnected valve and stopwatch.

Shortly after the completion of these instruments, in consequence of the enormous increase in the number of nozzles being manufactured, it was considered necessary that an instrument should be produced in which the time element could be eliminated, and to this end a number of gasoline flowmeters were placed on order. After much labor and experimental work an instrument was produced which proved thoroughly satisfactory in every respect, and with the exception of certain alterations in details of design which have been rendered necessary by the ever increasing sizes of jets required, has remained unaltered in principle until the present day.

Toward the end of 1916 a serious fault was discovered in the standards which had been used for the calibration of the Mark I flowmeters, it being found that the effective head in the master time instrument was varying considerably with the size of nozzle being calibrated; this was due to the control valve being of insufficient size, which caused considerable restriction in the gasoline flow during calibration of the master nozzles. This defect had but very little effect when the maximum size required was in the order of 350 c.c. per minute, but with the advent of nozzles passing 700 to 800 c.c. per minute, required for the more powerful engines then coming into use, it became necessary to alter the master instrument, and to supersede Mark I calibration by Mark II.

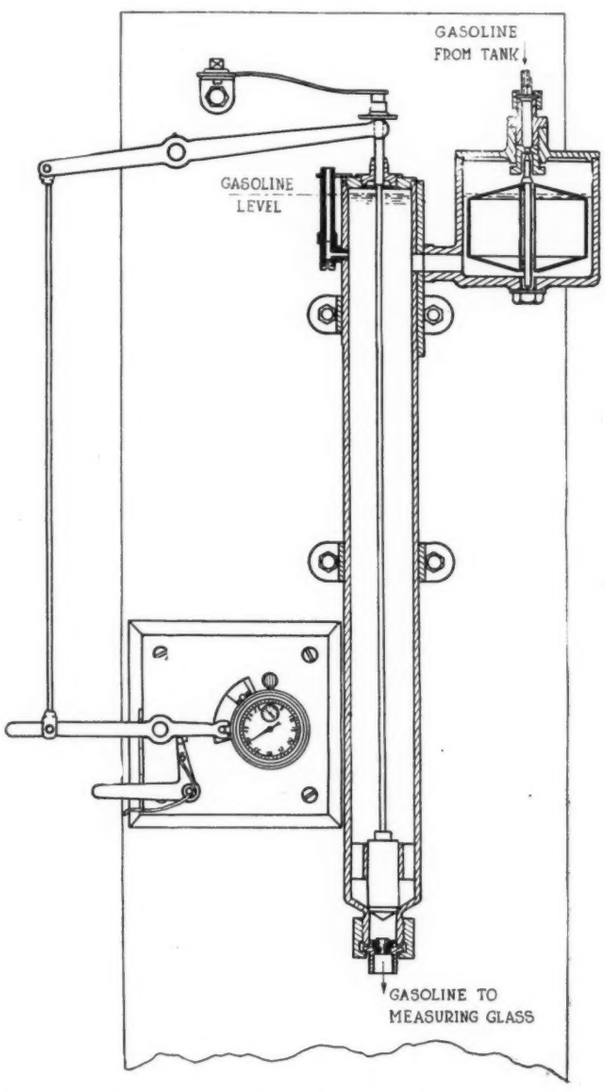


Fig. 2—Sectional view of master time flowmeter

Having arrived at the finally perfected and standardized Mark II instruments, a brief description of their construction and method of working will be given and, since the root principle has never changed, this will cover the whole range of instruments previously described.

Fig. 2 is a sectional arrangement of the master time instrument. It consists of a vertical tube A, fitted at the lower end with a control valve B, and with an adapter to receive the master nozzles shown in position at C; a constant level of gasoline 50 centimeters above the nozzle orifice is maintained by the float feed mechanism D.

The valve B is normally closed by the spring E, and is opened when required by the lever F, which is interconnected with the stopwatch lever G. The stopwatch lever when placed in the "on" position is retained "on" by the trigger H.

Gasoline is supplied to the float chamber from a tank above the instrument, and after passing through the nozzle is collected in the bottom tank, being returned to the upper tank for further use by means of an air pump.

Calibration of Master Nozzles

The method of calibration of the "master" nozzles is as follows:

Accurately made nozzles having all edges carefully rounded and with a length of "stricture" not less than three or more than five diameters of the actual orifice, are inserted in the adapter. The lever is pressed into the "on" position and gasoline is allowed to run for a minute or so to get rid of any air which may be present below the valve.

The trigger H is then released, thus closing the valve. The stopwatch is now set to zero and a graduated measure being placed under the nozzle, the control lever is again pressed into the "on" position, and gasoline is allowed to flow through the nozzle into the measure for one, two, three or five minutes, according to the size of the nozzle to be calibrated. It will be seen that the actual time during which gasoline is flowing is recorded by the stopwatch, and that should the operater fail to close the valve exactly on the minute intervals it is a simple matter to divide the actual time registered into the quantity of gasoline in the measure, and so obtain the exact quantity passed per minute. Fig. 3 shows a purely diagrammatic arrangement of the "flowmeter" type of instrument; this will be dealt with in the last section of this paper.

The principle upon which this instrument works may best be described as follows: A and B are vertical tubes connected at their lower ends by the venturi passage C. Tube A is coupled to a float feed mechanism which maintains within it a practically constant level of gasoline whatever may be the quantity passing away through the venturi C. Tube B is provided with an outlet at D controlled by a stopcock. It will be evident that when the stopcock is closed gasoline in tube B will reach the same level as in tube A, but if the stopcock is opened, the level in tube A will remain constant or practically so, but the level in tube B will fall to some point at which it will remain stationary, the amount of the fall depending upon the quantity of gasoline flowing from the stopcock, providing of course that this quantity is within the range of any particular instrument.

The range of difference in the height of the gasoline in the tubes is controlled by the discharge, under the constant head, through the venturi orifice, which in the instrument takes the form of an accurately made and carefully calibrated nozzle.

Formula for Scale of Flowmeter

The formula for calculating the scale graduations when the instrument is used as a measuring flowmeter is

$$Qa = C\sqrt{2gh}$$

or

$$h = \frac{Qa^2}{C^2 2g}$$

Where Qa = Actual cubical discharge from the delivery side of the instrument.

h = The difference in height between the constant head on the supply side of the instrument and the reduced head on the discharge side.

C = The coefficient of discharge of the venturi orifice, which varies with the area of the orifice *and with variations of the detail design of each type of instrument*; therefore it is, of course, essential that the value of "C" be carefully determined experimentally in every case.

The Mark II nozzle calibrating flowmeter has two progressive scales which are calibrated, not in unit volume passed by the nozzle being tested, but to correspond with the amount passed by the corresponding master nozzle when this is tested in the master time instrument under a constant head of 50 cm.

How Instrument Is Used

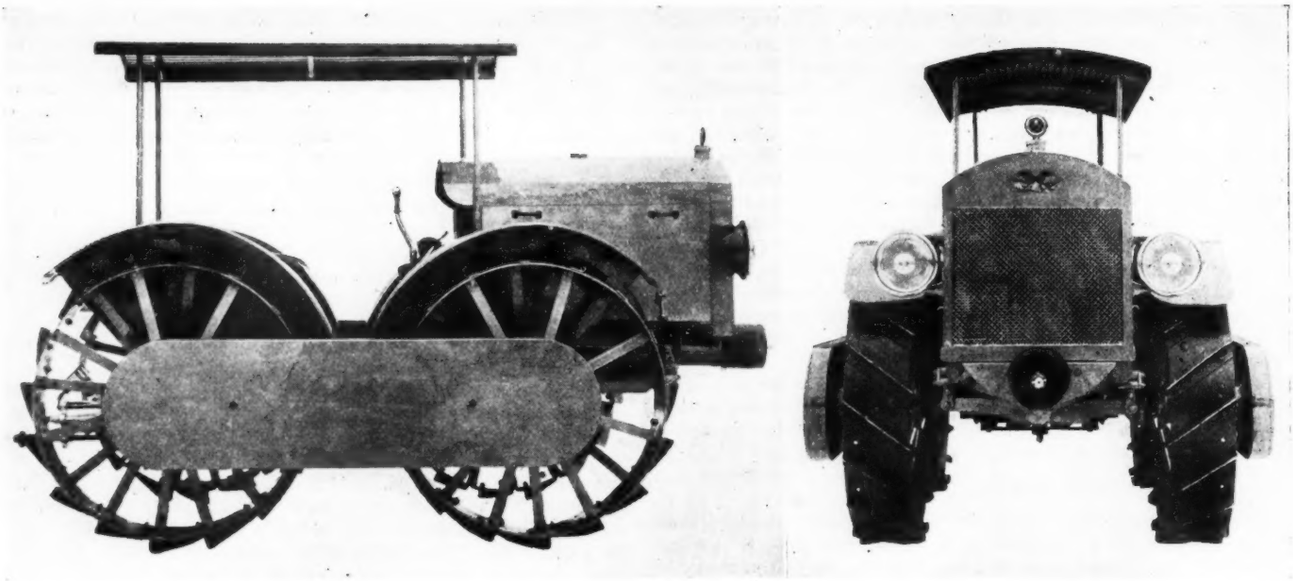
When using the instrument, the nozzle to be calibrated is inserted in a special adapter, under the scale upon which its desired size is found. The gasoline cock at the base of the gage tube is opened, and after the air trapped in the adapter has been released by means of the valve provided for this purpose, the level of the gasoline in the gage tube will drop and remain stationary at a figure upon the scale which denotes the size of the nozzle which is being tested, and it will be evident that this provides a method of nozzle calibration into which the personal equation of the operator cannot enter, since there is no measurement of time or of quantity required. It is desired to emphasize particularly the fact that the numbers given upon the scales indicate the quantity of gasoline which the corresponding master nozzles would pass under the constant head of 50 cm., but as the head actually acting upon the nozzle in this instrument varies with the size of the nozzle being tested, the actual quantity of gasoline passing through the nozzle will not be the quantity which is indicated upon the scale.

Types of Gasoline Flowmeters

When official acceptance tests of aero engines were first instituted, and in fact until some appreciable production had been reached, the usual method of obtaining the fuel consumption was to commence the test with a measured quantity of gasoline in the tank, and, having run the engine for the period required by the testing schedule, to empty out and measure the amount of fuel remaining in the tank. This had very grave disadvantages, in that serious inaccuracies were possible owing to carelessness upon the part of the workman in filling and emptying the tank; the author has, in fact, at the conclusion of a test frequently seen a measure being so held that gasoline was running directly on to the floor, the holder in the meantime being busily engaged in discussing some point of great interest with a fellow worker! There was also a very grave risk of fire, but the most serious disadvantage was that during the actual running time there was no indication of any fluctuation of changes which might be taking place in the carbureter action. Also, it was not possible to see the result of any change or adjustment made in the carbureter without running the engine for some considerable period. Upon the successful conclusion of their work in connection with the Mark II nozzle calibrating flowmeter, Messrs. Brown & Barlow were requested to submit a flowmeter to meet the following conditions:

(1) Accuracy within plus or minus 2 per cent.
(2) Steady indication at any rate of flow within its range.
(3) Maximum possible range of scale to be obtained.
(4) Length of connections between the instrument and the engine not to affect accuracy.

This instrument was produced and was tested, being connected in series with the ordinary tank containing a measured quantity of gasoline. Readings were taken at intervals of fifteen minutes, and these were averaged at the conclusion of the test and compared with the reading obtained by actual measurement. The results of a considerable number of tests carried out in this manner showed the flowmeter to be accurate within less than ± 1 per cent; the only condition which was not quite fulfilled was that of steady indication under all conditions. This trouble was completely eliminated and a steady indication was obtained. A large number of the instruments were placed on order, being classified as engine test bench flowmeter Mark III.



Heinze Tractor Has Novel Drive

Equipped with Ball-Bearing, Kerosene-Burning Engine of New Design—Drives Through Enclosed Side Chains to All Four Wheels and Steers Like Creeper Tractor

THE four-wheel drive idea has had adherents in the automotive field from the early days of the passenger car and truck. In the passenger car field it never got beyond the experimental stage, because the advantages which it affords over the two-wheel drive do not warrant its complication and extra weight. In truck practice the four-wheel drive has conquered quite a field in recent years, mainly in connection with ordnance transport. It would seem that if this drive had any justification at all, it would have it in tractor work, because a tractor must develop driving effort sufficient not only to propel its own weight over loose soil but to haul a plow or other implement as well. Driving lugs of suitable design no doubt serve greatly to increase the limiting traction, but these add to the weight to be moved, and they also consume power. It is obvious that even with four-wheel drive it would not be possible to use smooth steel rim driving wheels, but the lugs could be made much smaller. That four-wheel-driven tractors have not reached the production stage before this is probably due to the fact that the complication and heavy manufacturing costs ordinarily associated with four-wheel drives has deterred manufacturers from adopting it. The chain tractor is in a way equivalent to a four-wheel-drive machine, as it makes the whole weight of the tractor available for traction purposes.

A four-wheel-drive tractor of unusually simple construction, known as the Heinze, has been placed on the market by the Traction Engine Co., Boyne City, Mich. The complication of the ordinary four-wheel drive is owing to the fact that the front axle has to be arranged for both driving and steering. That is, assuming the Ackerman steering is to be used, the front-wheel spindles have to be pivoted on the axle, and universal joints have to be used for transmitting the power from the axle to the wheels. Mr. Heinze has avoided this difficulty by steering on the same principle as a creeper-type tractor is steered; that is, applying brakes to the two inner wheels, so that driving power will be applied to the two outer wheels only. All the wheels, therefore, remain at all times parallel with each other, and there is no difficulty in driving the two wheels on each side through a single chain. Some people might question the effectiveness of this method of steering, but the manufacturers claim that the machine turns at right angles and in a radius less than its length.

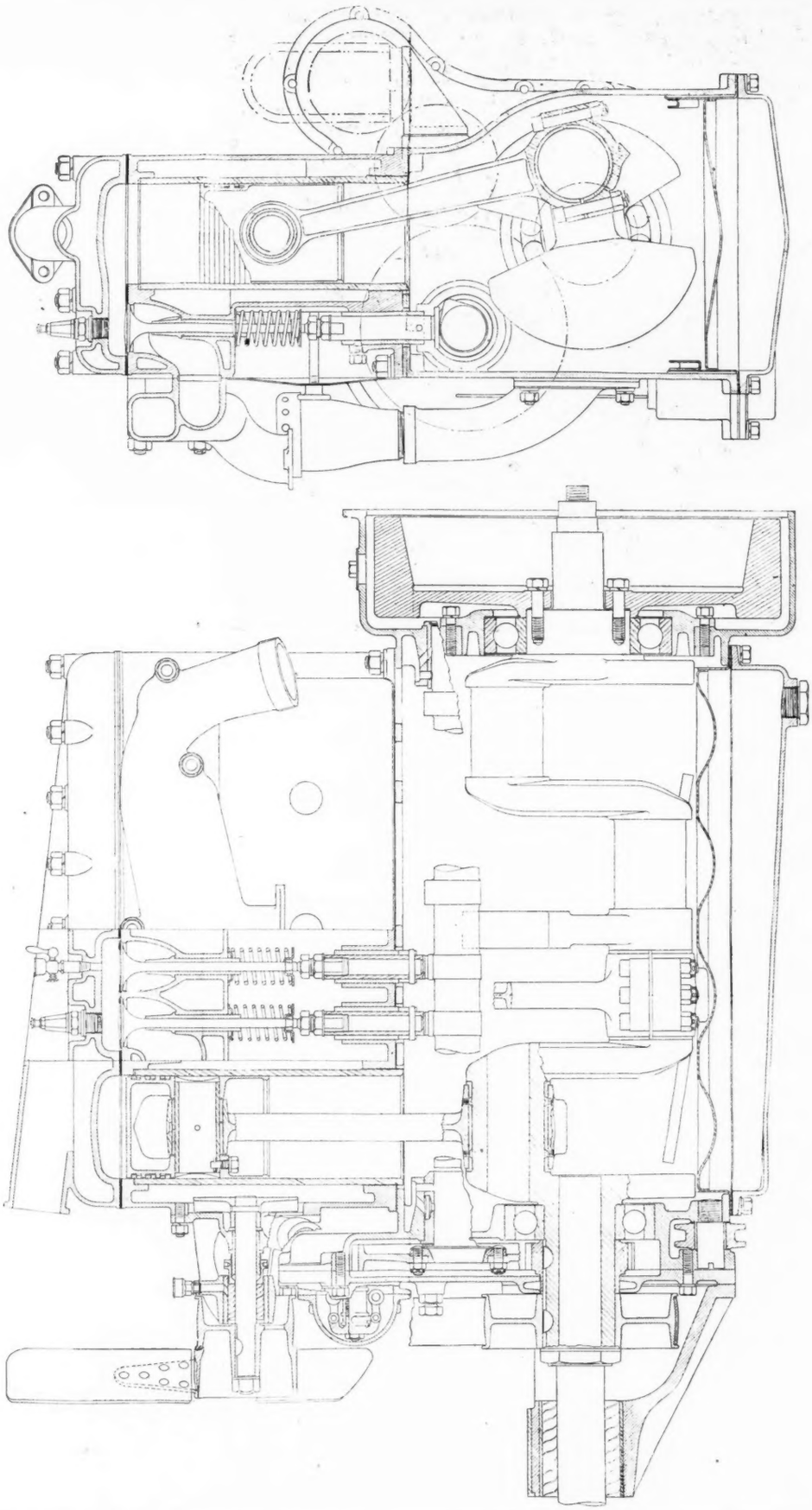
We will first describe the engine, which is of Mr. Heinze's own design, and manufactured by the Traction Engine Co. In this connection it is worth noting that John A. Heinze was formerly general manager of the Northway Motor Mfg. Co., of Detroit, and consequently has had extensive experience in the design and manufacture of gasoline engines. His new engine is of the four-cylinder block type, with detachable heads. Among its most notable features are the use of case-hardened steel liners for the cylinders and two ball bearings on the crankshaft, together with balance weights on it. The engine is of 4¼-in. bore by 6-in. stroke, and is of low compression, in view of the possible use of kerosene as fuel. The cylinders are of the L-head type, all of the valves being located on the left-hand side. The valves have a clear diameter of 2 in. and a lift of ⅜ in. It is notable that there is a large filler between the valve head and valve stems. Mushroom-type cam followers are used, and the camshaft is forged integral with its cams, in the usual way. This camshaft is supported in two bearings only, and consequently is of unusually large diameter, 2 in.

Crankshaft of Unusually Heavy Dimensions

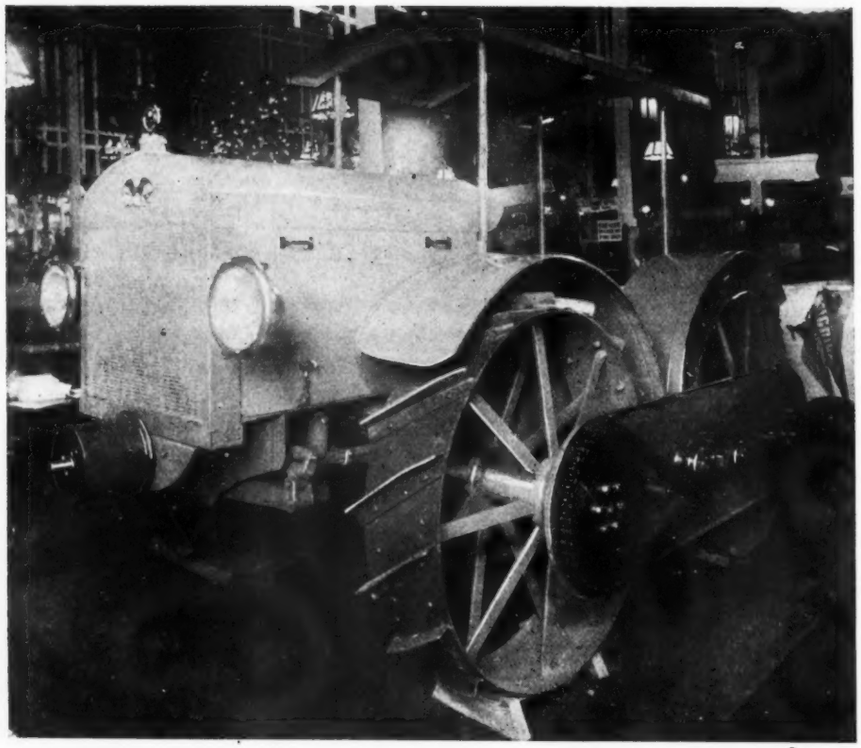
The crankshaft is a drop forging of unusually heavy dimensions. It has crankpin bearings measuring 3 x 3¾ in. The crankshaft is carried in two annular ball bearings, a No. 315 medium series at the front end, having a rated load capacity of 4400 lb., and a No. 222 light series at the rear end, having a rated load capacity of 5000 lb. Balance weights are forged integral with the two short arms of the crankshaft, and there is also a heavy balance weight between the central double crank pins. In order to reduce the weight of the crankshaft, both the crankpins and the main bearings are bored out. The crankcase is cast in a single piece, open at the bottom.

The pistons, which are of cast iron, are provided with three sets of two rings at the upper end. The hollow piston pin, which is of unusually large diameter, is fastened in the piston bosses, and the bronze-bushed connecting rod rocks upon it. Cast integral with the crankcase is a bell housing for the flywheel. The piston-pin bearings measure 1⅞ in. in diameter by 2⅜ in. in length, and the connecting rod has a length

Heinze 30-40 Hp. Engine for Farm Tractors



Among the noteworthy features of this engine are the very rugged crankshaft and camshaft, the crankshaft ball bearings, hardened steel cylinder liners, crankshaft counterweights, pump and fan on same shaft and high-speed centrifugal governor



A view of the Heinze at the Tractor Show, with chain cover removed

of 13 in. There is also plenty of bearing surface on the pistons, which are 6 in. in length. The timing gears are made of steel and cast iron, for the pinion and gear respectively, and have helical teeth.

Ordinarily the tractor is fitted for operation on kerosene, and a kerosene capacity of 20 gal. and a gasoline capacity of 2 gal. are provided. A combination inlet and exhaust manifold is used, so that some of the heat of the exhaust can be utilized in vaporizing the kerosene. Ignition is by a high-tension magneto. Lubrication is by splash, the oil being circulated by pumps. There is an oil capacity of 3 gal. in the crankcase.

The cooling water is circulated by means of a centrifugal pump, which comprises only an impeller, the ordinary pump housing being dispensed with and the impeller located directly within the engine jacket. Both the pump and the fan are mounted on the same shaft and are driven by a 2-in. flat belt. The fan has 3 blades, and is 20 in. in diameter. A centrifugal governor is mounted on the foreward end of the magneto driving shaft.

Transmission

A large Raybestos-faced cone clutch is located within the flywheel. The transmission is of the sliding-gear selective type, and gives three forward speeds in addition to the reverse. All transmission shafts run on large annular ball bearings and operate in oil. From the main shaft of the transmission the power is transmitted to the differential shaft through a worm and worm wheel. This differential shaft, which is located transversely on the frame, midway between the front and rear axles, extends all the way across the tractor, and carries a sprocket pinion on each end. From these sprocket pinions the transmission is by two chains to the four driving wheels, an idler sprocket being used on each chain for taking up the slack.

The roller chain is enclosed in a steel housing and operates in oil. The small driving sprockets and the chain idler sprockets are carbonized, heat treated and ground; the large sprockets are made of steel, and have machine-cut teeth. Every bearing of the drive is provided with a pressure grease cup.

The belt pulley, which is located at the forward end of the tractor, is of 8 in. diameter by 8 in. face and is crowned. It operates at a speed of 1200 r.p.m., and sets directly upon a forward extension of the engine shaft. A substantial bracket bolted to the forward end of the engine crankcase supports this shaft extension on a Hyatt roller bearing.

As will be observed from the longitudinal sectional view of the engine, the latter is arranged for three-point support upon the main frame. At the forward end the frame is supported on the axle by means of half-elliptic side springs, and in order to insure greater flexibility the forward ends of these springs are not shackled directly to the frame but to a cross-bar, which is swiveled to a cross-member of the frame in front. All four driving wheels are of the same diameter, 42 in., and also have the same width, 10 in. With lugs attached, the width is 12 in. The overall length of the tractor is 125 in. and the overall width 72 in. Without canopy the height is 62 in., and with canopy, 86 in.

A laterally adjustable drawbar is provided. The road clearance is 14 in. The tractor is equipped with fenders, and it also has front and rear lights for night plowing.

The engine rating is 30-40 hp. at 1200 r.p.m., and the tractor weight is 4000 lb. At a speed of 1 mile per hour on hard, soddy soil, the tractor will deliver a pull of 6000 lb., while at a speed of 3 miles per hour on loose sandy soil it will develop from 3000 to 3600 lb. drawbar pull. It is sold as a 3-4 plain tractor.

Use of Coal Gas as Motor Fuel in France

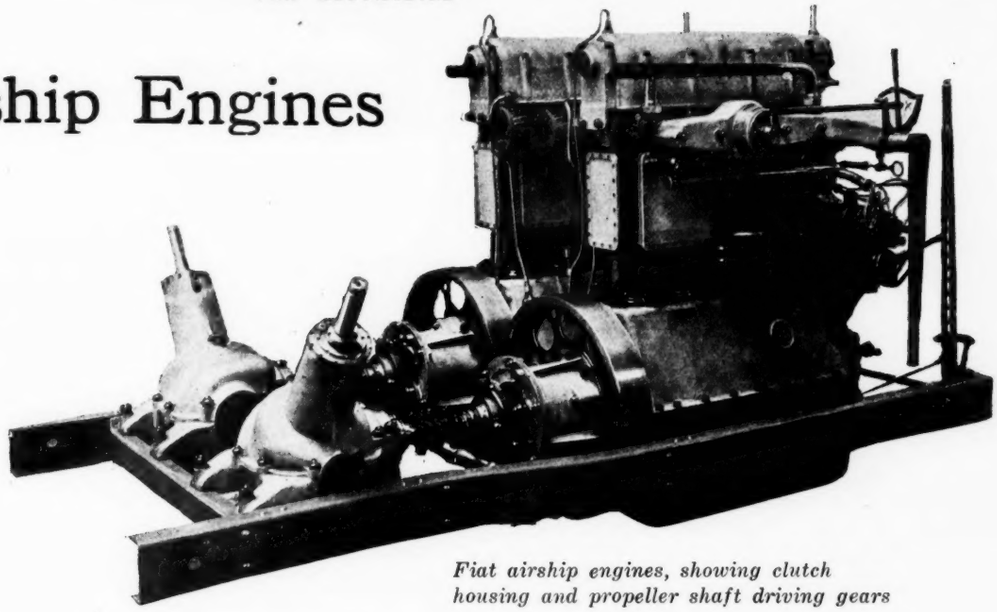
BEFORE the war the scarcity and expense of volatile liquid combustibles was causing anxiety in France, Italy and Germany, and the war has greatly increased it. One of the means of obviating the difficulty is to employ illuminating gas, of which 1.650 cu. m. at 4700 calories is equivalent to 1 litre of gasoline of a specific gravity of 0.730. The annual consumption of gasoline and of benzol produced from coal before the war had attained 350,000 tons, of which 130,000 tons was benzol. Now the consumption is about double. In the gas-works of France about 30,000 tons of benzol are being produced yearly, and when the coking plants in the Nord area are reinstated the output should reach 50,000 tons. French benzol only represents some 7 per cent of the total requirements of France. The consumption of internal combustion engines varies from 2500 to 3000 calories per hour, and assuming an average of 2750 calories this is represented by 0.25 kg. of benzol.

Gas from which the benzol has been extracted has a thermal value of about 4700 calories per cubic metre at atmospheric pressure and about 0.3 kg. by weight. The present price of benzol is more than 1 franc per litre outside Paris, and gas 0.3 franc per cubic metre not compressed, so that the cost of benzol per mile may be taken as double that of gas.

In a recent article in *Le Genie Civil*, the author, after quoting the practical results obtained in England, describes what has been done in France. L. Neu in 1913 took out a patent for an installation which permitted the use of either gasoline or gas upon a given automobile. Experiments have recently been made with a Renault of 8 to 9-hp. car, a Renault limousine of 12-14 hp., and a Renault 3-ton truck. Each was fitted up with an arrangement by which gasoline or gas or a mixture of both could be used, and the tests proved that about 1.7 cu. m. of gas of a thermal value of 4700 calories was equal to 1 litre of gasoline. They also showed that gas could be satisfactorily employed in all three types of vehicles without any serious structural alteration.

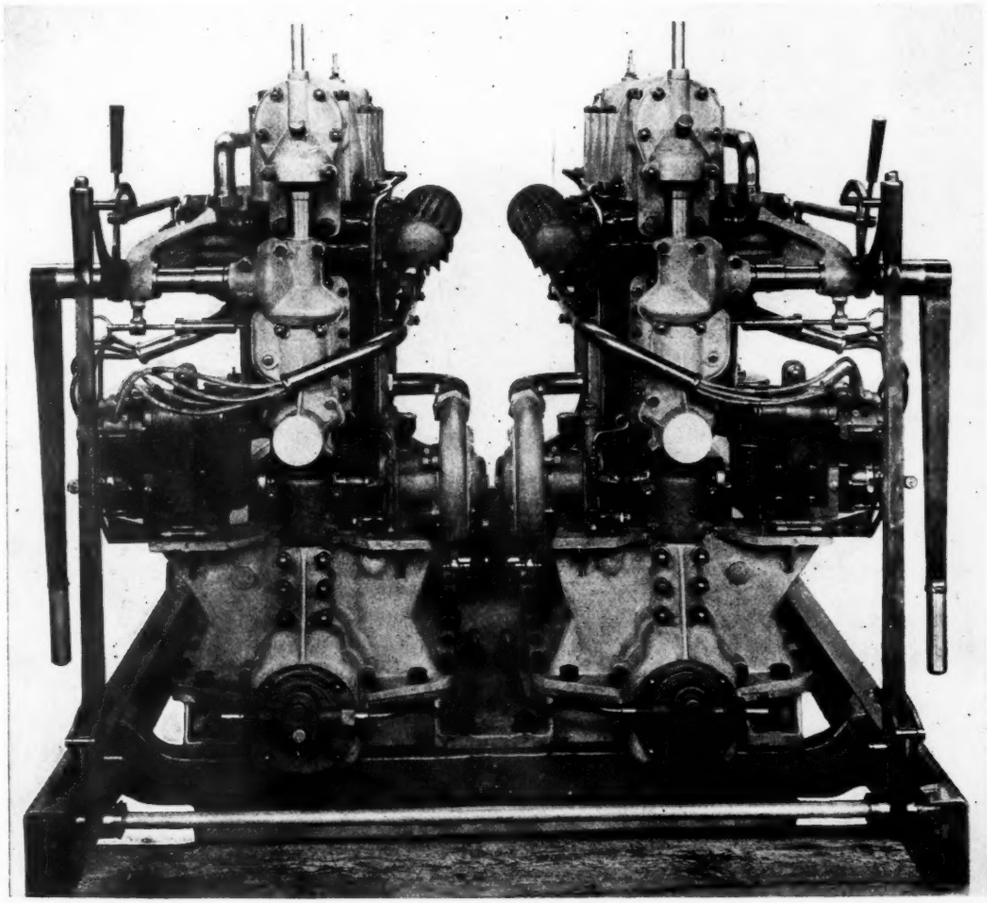
Fiat Airship Engines

Mounted in Pairs in a Channel Section Frame—Starting Gear Mounted on Camshaft Drive Shaft



Fiat airship engines, showing clutch housing and propeller shaft driving gears

DURING the war Italy made a very extended use of airships for coastal patrol work and for the detection of submarines in the Adriatic and the Mediterranean. The great majority of these airships were equipped with Fiat engines. The size and type of engine varied with the airship, but a very popular installation was a twin group composed of two four-cylinder engines placed side by side, and as close together as possible, in a channel section frame. These engines have a bore and stroke of 110 by 190 mm., the cylinders being a block casting, with enclosed valves in the head and large aluminum water jacket plates on the sides and the ends. The overhead camshaft is operated by means of an enclosed vertical shaft and bevel gearing, and advantage is taken of this shaft to mount the starting gear by means of a lever and bevel gearing. The carbureter is placed on the outside of each engine, while the exhaust is on the inside.



Front view of Fiat airship engine set

At the base of the vertical shaft the water pump and the high-tension magneto are driven by means of bevel gearing. These two organs are opposed, so that the magneto distributors and contact breakers are on the outside in each case. Each engine is fitted with a light flywheel and a coil clutch, the control of which is by means of a lever at the forward end of the engine. From the clutch shaft the propeller shaft is driven by means of bevel gearing, this shaft having an inclination of about 45 deg. from the vertical.

It will be seen from an inspection of the photographs that the two engines are not exact duplicates, but are right and left respectively, the design evidently making for accessibility.

Advertising Ideas to Sell American Goods Abroad

Successful Men Agree There Is No Single Rule, but That a Distinctive Plan, Made to Fit the Article and the People to Be Reached, Must Be Worked Out for Each Country

By Allen Sinsheimer

DOES advertising for export trade pay? What mediums and forms of advertisement are most profitable? These questions were asked at the group session on advertising at the recent Foreign Trade Convention and were answered by advertising authorities and business men with practical foreign experience.

Nearly every method of advertising used successfully for the development of domestic business, it was said, has been found appropriate and profitable in various foreign countries, but no blanket form of advertising can be applied to all foreign countries. Each country must be studied as to its customs, social, industrial and financial conditions, and the advertising must be as carefully adapted to each country as domestic advertising is adapted to the various articles of trade.

It was generally agreed that newspapers, American export magazines, local weekly and monthly publications, billboards, street car, railroad station, poster and handbill advertising are each successful in certain foreign countries. The application of any of these media, however, must follow a thorough practical and psychological analysis.

It is not possible, for example, to write an advertisement in the English language and translate it into Spanish with profitable results. No advertisement, the speakers asserted, can be written in English and translated into a foreign tongue without losing its selling force and appeal. Expressive American phrases are unknown abroad and the translation becomes meaningless. The advertisements should be written in the language of the country for which they are intended, by a native of that country or a writer familiar with both the country and its language.

Foreign Advertising Must Be Done By Manufacturers

Foreign advertising must be done directly by the manufacturers, and not through local dealers, who are likely to use the wrong media or carelessly expend the appropriations in wasted efforts. Expenditure of advertising funds directly by the manufacturer insures a consistent nation-wide campaign in place of spasmodic local efforts.

No two countries can be sold on the same publicity plan and this even applies to nations as closely situated as Brazil and Argentina. Many manufacturers have plunged into their foreign advertising campaigns without first making a careful survey of the fields and inquiring into the mental characteristics and material conditions of the people, their customs, peculiarities and systems. A proper survey of each nation includes:

The population.
The buying power per capita.
Literacy and illiteracy.
Importance of women and the family.
Native industries.
Superstitions.
Average wages paid.
Agricultural conditions.
Highway, general topographical and climatic conditions.
Local and national taxes.
Native customs and peculiarities.
Retail distribution.

Investigation of Local Conditions Essential

Stories are told of American manufacturers who have wasted huge sums by not first investigating these factors; of the implement maker who advertised lawn mowers in China where they have no lawns; of the syrup advertised for pancakes in Peru where they know nothing about pancakes; of the chewing gum advertised as a cure for smoking in Argentina, where the Argentinian would give up his all for a life-long supply of cigarettes. Similarly it is futile for an automotive manufacturer to advertise automobiles in a country where the highways are too narrow to allow their use.

The buying capacity per capita is an important consideration in apportioning the foreign advertising appropriations. Such appropriations will be most successful in those countries, other conditions being equal, where the buying power per capita is the greatest as a result of a more universal prosperity.

Literacy and illiteracy are fundamentals in the preparation of foreign advertising copy. In the Latin American countries particularly, where 50 per cent of the people are unable to read or write, advertising should consist chiefly of illustrations and simple phrases, with the prices conspicuous and plain. In Cuba, for example, the people are of an easy-going, pleasure-loving nature, not over fond of thinking and are attracted more by what they see than by what they read. The appeal to sight by means of large billboards or electrical displays, calling attention to the gorgeous upholstery and brilliant finish of the automobile, is most successful, and the best Cuban advertisements in magazines are those in which the illustrations have local color, drawn by either a native artist or some one who knows the country and the people, with the trade-mark or brand name well played up. Price is important. The text should be brief and to the point.

The importance of the women in the home is a consideration that should influence passenger car advertisements. Woman's situation varies in different countries and while in some she can be an important influence in the sale of a car, she may have little or no influence in

others. Latin American women have but little influence on the purchases for the families and are chiefly proud of their domestic qualities. They are likely to be more proud of a washing machine than of an automobile.

Superstitions, also, are important and particularly so in the preparation of advertising copy which contains illustrations of the commodity and its trade-mark. The Chinese, for example, have numerous superstitions, consider certain symbols unlucky and cannot be persuaded to accept commodities bearing what they consider ill-omens even as a gift. Similarly, there are many subjects which they consider lucky and they also exhibit a marked weakness for certain colors, buying those commodities regarded as lucky or which have the favorite colors even though not needing them. Certain countries give birds, animals or symbols high heraldic station and the selection of the trade-mark should be made with consideration of this if the mark is for that country only.

Retail distribution enters into advertising when it is of a local nature because of the customs of various countries. In the Far East it is customary to use the "compradore," a sort of go-between who acts between your representative in the field and the native. In China the compradore acts as the Chinese manager and credit man, usually furnishing cash guarantees and meeting obligations which have not been paid by the customer. As a rule the compradore is an influential, well acquainted individual and local advertisements referring to him are the most profitable.

Advertising media demand as much analysis as the preparation of the copy itself in each country. The use of cut-outs, calendars, post cards, souvenirs and attractive illustrated trade literature for distribution by local dealers has been found an excellent plan in some countries, magazines, daily newspapers, posters and handbills in others, while still others respond more readily to billboards and railroad station and street car displays. Particular stress was laid by all the speakers on the value of American export trade publications, which, it was said, are looked upon, especially in South America, as monthly or weekly catalogues of the American products of the industry represented, and in the case of reputable papers are highly regarded.

The use of local newspapers in Argentina, Brazil, Peru, Australia, South Africa and the Far East has been found profitable, according to Howard G. Winne of the Johnson Overseas Co. Billboards, posters and handbills are successful in China. Posters have been profitable in Argentina. The railroads of Uruguay and Argentina are owned by British companies who have followed the British system of display advertisements in the railroad stations, and the natives have come to understand them and respond favorably to them. The street cars of Brazil are owned by American capitalists who inaugurated the American system of advertising in the cars and Brazilians have become accustomed to this form of advertising.

The newspapers of each country must be studied separately to determine the selection. This applies also to the local and national weekly and monthly publications. Many of the publications reach only certain class trade, as, for example, there are more than 500 newspapers published in Buenos Aires, 100 of which reach specific foreign colonies only. Sunday papers in foreign countries, unlike the American Sunday papers, are worthless and useless. The various large advertising agencies of this country with foreign trade departments have made a study of most of the papers and are in position to advise the manufacturers. Although there are many newspapers and magazines, the good ones are so obvious by contrast that the selection of media is relatively an easy matter. In many countries the newspapers fill the place of both magazine and paper and are read both in the home and at business.

Manufacturers will find, it was stated by all the speakers, that those American advertising agencies which have established foreign advertising departments have anticipated the development of export trade and have made research in many countries and have complete data for analysis of the different markets. They have on hand information showing the appropriations necessary to conduct a successful campaign, the kind and style of copy that is most effective and the most effective media for placing it before the public. The American Association of Advertising Agencies is compiling a report of sources of available information on foreign advertising and foreign business which manufacturers planning a foreign campaign will find beneficial.

That advertising abroad is successful was shown by examples of selling, ranging from 25 cent cans of talcum powder to highly priced machinery, which have been sold through export publications, foreign and local newspapers, weeklies and other media described above.

If a manufacturer or his advertising manager, after ascertaining that there is a market for his product, will secure a thorough knowledge of this market, applying the same conservative, well considered and developed selling and advertising methods that he applies to the cultivation of his home trade, he can undoubtedly secure even more profitable results abroad for a given expenditure than he can at home. W. G. Hildebrant, of the Gotham Advertising Agency, cited a number of firms, some of which appropriated less than $5,000 for the first year, that are successfully selling manufacturing tools, soaps, toilet lotions and various other commodities at a wide range of prices, as a result of judicious advertising.

But it must be remembered, agreed all the speakers, that there is no cut and dried plan, no rule of thumb method which can be successfully applied to all products or to all markets. Each market must be analyzed.

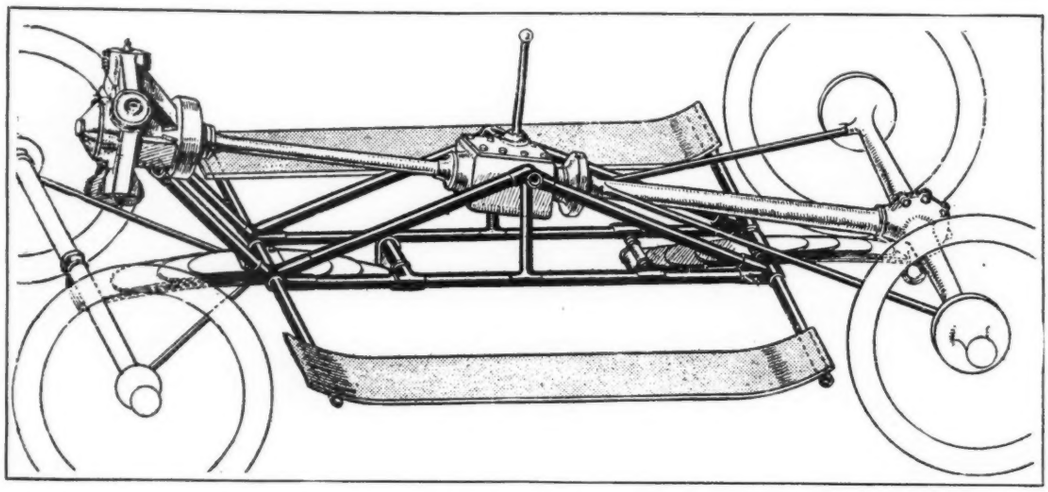
MANUFACTURERS who have successfully built a foreign trade in American merchandise agree:

Reputable American export journals are indispensable as advertising mediums in building up a dealer clientele. These journals are regarded by dealers as catalogues of what is new in the industry represented.

The mediums for reaching the consumer are as numerous abroad as in this country, but usually they need not all be used in one country. Billboards, posters and handbills, if well illustrated, reach the Chinese. Newspapers and posters are profitable mediums in Argentina. Colored pictures appeal best to the Cubans. Newspapers, if well selected, are useful in Brazil, Peru, Australia and other countries.

Radial Engine Revived in England

Cycle-Car Type of Machine with Five-Cylinder, Air-Cooled 10-Hp. Engine to Be Marketed by Enfield-Allday Co.—Cloverleaf, Three-Passenger Body Fitted



Sketch of the general assembly of the radial engined car, showing the peculiar springing arrangement, also the tubular frame and engine bearers. This sketch is purely diagrammatic

TWO models of cars are provided for in the post-war program of the Enfield-Allday Co. of Birmingham. One is a six-cylinder four-pasenger touring car, while the other is a small 10-hp. radial engined car. The engine of the latter consists of five air-cooled cylinders bolted to a stationary crankcase in which is a single-throw, built-up crankshaft.

The crankcase is bolted to the frame. The crankshaft carries, at its rear end, a small flywheel, which is in reality a Sirocco fan, and is used to draw a current of air over the cooling flanges of the cylinders. The cubic capacity is 1208 c.c. (74 cu. in.), while the bore and stroke are 62 x 80 mm. (2.44 x 3.15 in.). The maximum horsepower is 20.5 at 2500 r.p.m.

The engine itself is placed in the orthodox position in front of the car under a hood of circular shape.

In place of the radiator there is a perforated screen which is hinged at the top, and can be lifted up for inspection purposes. By a rather clever arrangement it is possible to disconnect the engine and swivel it, so that any desired cylinder can be brought round to the top. (Care should be taken not to confuse the radial with the rotary engine, the latter being the type mostly used in airplanes and having a set of cylinders revolving round a stationary crankshaft. The radial is another type.)

Each cylinder forms a separate casting, with a series of circular radiating fins extending from near the base up to the combustion chamber. Arranged centrally at the top of the cylinder proper, but of less diameter, is the combustion chamber with two series of valve ports round it. The valves, which are operated from overhead, consist of two concentric sleeves, the exhaust resting on a bevel seat in the cylinder extension, similar to a poppet valve seat, while the inlet has a seat formed on the inner circumference of the exhaust valve and normally covers a series of ports cut in the latter, through which, when the inlet is raised, the exhaust gases pass.

The valve mechanism imparts to the valve sleeves (as they may be termed) a slight reciprocating movement lifting them from and returning them to their seats, as is the case with poppet valves.

As regards their operation, no camshaft is used, but the large wheel of the two-to-one gear is provided with a side flange, on which the cams are formed, and a simple actuating mechanism is connected up by rods—mere wires under tension—with the overhead levers. The latter are acted upon by the valve springs, which are situated externally, and not affected by the temperature of the cylinder walls.

Advantages Claimed

The following points are claimed for this system of cylinder and valve construction: Absolute uniformity of cooling; an extremely large valve opening area in proportion to cylinder capacity, with a very small valve lift; the explosion terminal pressure does not resist the opening of the exhaust valve, thus enabling the valve-operating gear to be of very light construction; both valves can be removed with the cylinder head by taking off four easily accessible nuts; and, lastly, no leakage of oil can occur from the valve mechanism.

The pistons are of the slipper type, made of aluminum alloy, with four rings. The crankshaft carries a master connecting rod running on a plain bearing on the crank and supporting on its big end four articulated connecting rods for the remaining four cylinders. The big end has no bolts, being formed in one piece, and threaded onto the crank pin when the built-up shaft is assembled.

Lubrication is by the dry-sump method. A double pump is used, one section of which forces oil through the hollow crankshaft, while the other sucks up all the surplus oil from the base of the crank chamber and returns it to the oil reservoir at the side of the machine. An advantage claimed for this system is that the lubricant is kept cool and clean.

The magneto and carbureter are of orthodox design, although the latter embodies an extra air inlet which is controlled by hand.

The transmission is by means of a single-plate clutch connected by a long hollow shaft to the three-speed gearbox, having the lever mounted centrally upon it. From here the drive is taken through an enclosed propeller shaft to helical bevel gearing in the back axle.

Central Cantilever Springs Used

The system of springing is quite novel, and departs entirely from the usual design. The springs themselves are but two in number, both cantilevers, and are arranged *centrally* in the frame, one at the front and one at the rear. Outriggers project from the frame at each side to support the body, while at the front end of the propeller shaft casing is a flexible connection with the body to prevent undue side sway, which would otherwise occur in the absence of a spring or other support at each corner. Triangulated rods are provided, both in back and front, to keep the axles at right angles with the center line of the car.

The makers state that the object of this novel form of spring construction is to reduce vertical oscillation of the frame to a minimum. In addition it is claimed that the car will hold the road better and that an appreciable reduction of weight is secured.

The standard body supplied with the radial engined car is a three-seater of "cloverleaf" pattern. The top, which encloses all three seats, folds back into a special compartment out of sight. The body itself is built on aero construction lines. It closely approximates streamline form, with inswept sides and a bulbous back. To render accessible the gearbox and other details beneath the body the latter is pivoted or hinged at the rear end, so that it can be raised up several feet at the front end. The wheels are of the pressed steel disk type, and are of unusually large diameter for a car of this size, being 810 x 90 mm.

The wheelbase is 8 ft. and the track is 4 ft.

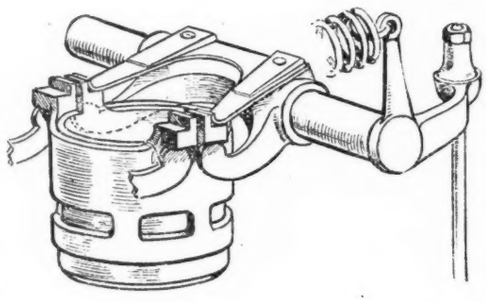
It may be pointed out that the aim has been to design a light attractive type of sporting car, providing exceptional speed with the comfort of running of much more costly vehicles. Reduction of weight should insure not only marked improvement in acceleration and hill-climbing, but also a reduction in running costs as regards both tires and fuel. As regards the latter, economy should be apparent, owing to the practical increase in cylinder temperatures obtained by the adoption of air cooling, and a design enabling these higher temperatures to be attained without distortion of the cylinders and valves.

The Six-Cylinder Model

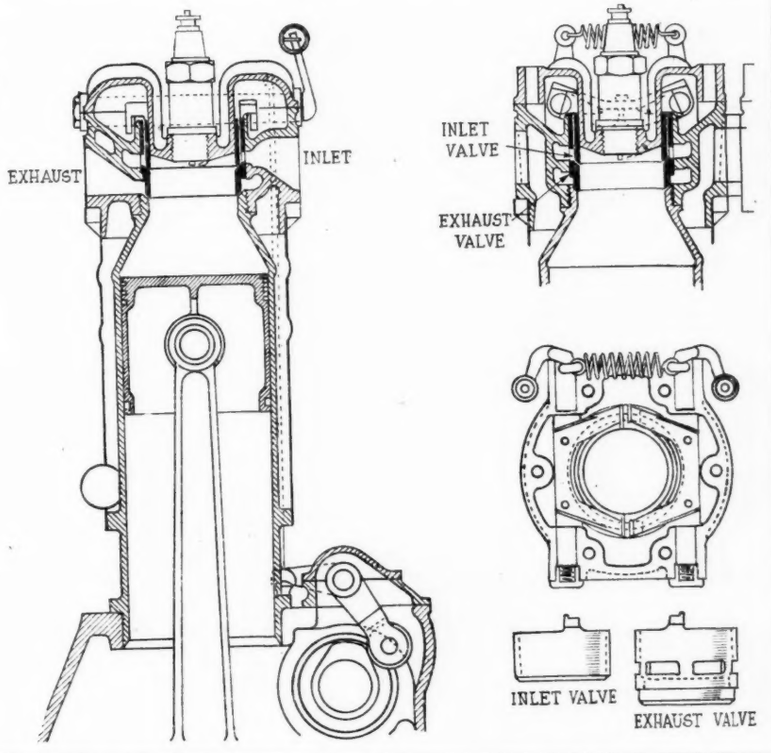
The second type being built, already referred to, has an engine with six cylinders of more normal arrangement; that is to say, they are water-cooled, and are vertical and in line on the top of an aluminum crankcase. The same valve system is used as the one already described. Each cylinder is a plain tube, reduced in diameter around the valve and combustion chamber. To secure uniform thickness, and consequently that uniformity of cooling which prevents distortion, each cylinder is machined inside and out and has a narrow water space enclosed by a steel jacket through which the water is circulated by a special force pump. Provision is made for relative movement, due to unequal expansion, between the cylinder barrel and the jacket.

The bore and stroke are 70 x 110 mm. (2.75 x 4.33 in.), giving a piston displacement of 2500 c.c. (153 cu. in.) and delivering 21 hp. at 1250 r.p m.

The remaining details are much the same as those of the radial engined car. Both cars are sold complete with electric lighting and starting sets—the 10-hp. car for $1,275 and the larger for $2,495.



Above—Sketch showing the method of operating the sleeve valves. The complete fork shown takes effect on the inner, or inlet valve, while the outer valve, the exhaust, is operated by a similar fork mounted the same way on a transverse spindle



Right—Three partly sectional views, showing the Enfield-Allday valve system

Fig. 1—Continental receiving and shipping department, showing the loading platform on the extreme right, and the checking-in floor of the receiving department on the left

Continental Plant Layout Facilitates Production

Engine Shipments Go Out on Same Tracks on Which Raw Parts Enter—True Progressive System Used

MATERIAL production at the Detroit factory of the Continental Motors Corp. moves around the four sides of a square. By this arrangement manufacture and assembly are carried out along strictly progressive lines without the necessity for the long, narrow buildings generally required for this purpose. In fact, the finished engines leave the shipping room, just across the freight siding, alongside of which is the receiving room from which the raw parts were originally started, and the same cars which came in with the raw material go out with finished engines. A very ingenious plant layout has permitted this result to be achieved.

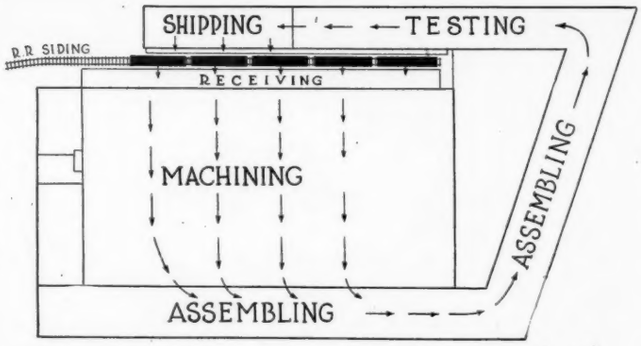
If the operations in the manufacture and assembly of the 250 to 300 engines now daily passing through the plant were strung out in a line the building required would be extremely long and narrow and would necessitate long walks on the part of officials in reaching various parts of the plant. As it is, the plant dimensions are 560 by 760 ft., or 425,600 sq. ft. Through this plant there pass more than 100 tons of raw material per day, of which about 90 tons are transformed into finished engines. There are about 2,100 productive men employed in the manufacturing departments, these men working on 8-, 9- and 10-hr. shifts. Six different models are being manufactured, but there are about 75 sub-types.

The layout and arrangement of the plant can be understood from the map herewith, which makes plain how it is possible to take this practically square plant and yet have true progressive manufacturing and assembling methods. As will be seen from the map, the freight siding enters the rectangle and runs practically across it near one end. This divides the plant roughly into a process department and the testing and shipping work department.

Leaving the freight tracks on one side, the materials enter the receiving department, then the stock bins, pass across one side of the rectangle through the manufacturing departments until they strike the assembly department on one end; whereupon they pass around the other three sides of the rectangle, finally terminating at the shipping platform, where the finished engines are placed in the same cars which brought in the raw material.

The methodic handling of material commences even before the freight cars enter the receiving department. The cars are shunted around in the yard outside of the plant until those containing material which goes to the far end enter the building first, and the cars which contain material near the door enter last. Thus, as the cars come in on the track the materials are approximately in the place where they should be. Fig. 1 shows this track. In this illustration we are looking into the receiving department in the direction the cars enter. The unloading platform is subdivided from the receiving and inspection department by the white line running parallel with the track. Material which has been received must be kept within this line, and the area parallel with the track laid off by this line forms the receiving platform. The materials are inspected immediately upon receipt and placed on standard racks adapted to carrying them. All of these racks are raised from the floor on blocks of wood, so that it is possible to slip the low platforms of the industrial trucks beneath them, raise them from the floor and carry them to the stockroom. In Fig. 2 is shown one of these industrial trucks raising some cylinder blocks which have been inspected, these being taken to the stockroom by the receiving department truck.

Receiving inspection is completed before the materials enter the bins. There are gages of all sorts to check over the material which is fabricated or semi-fabricated outside. Thus, the accuracy of the incoming parts is given a thorough check before they enter the raw stockroom, and for manufacture, all material and semi-fabricated parts are drawn from finished stock; thus the finished stockroom forms a division between the receiving department and manufacturing.



Layout of the Continental engine plant, showing the compact, progressive system of manufacture. The rough parts are unloaded from one side of the freight cars and pass through the machine shops to the assembly chains, at the end of which the engine is tested, packed and shipped into the same freight cars from the opposite side

An interesting type of bin is used in the Continental raw stockroom. This is a hopper type for small parts such as timing gear blanks, etc., and is illustrated in Fig. 3. The material is used in approximately the same order in which it is put into the bin, the parts being drawn out at the bottom and put in at the top. In fact, they are loaded into the top of the bins, right from the receiving room, as will be noted by referring back to Fig. 1, where the open tops of some of these bins are shown along the left wall.

The raw material stockroom extends across one end of the manufacturing department and from this stockroom manufacture takes its start. The stockrooms are adjacent to the manufacturing departments which handle the parts contained in their particular bins, and the manufacture of these parts proceeds in parallel lines directly across the manufacturing department, terminating at the other side where there is a finished stockroom from which the parts are drawn for assembly.

In a few instances the passage across the plant would be too short to complete the manufacture of that part. In a case of this kind the parts double back and then, if necessary, back again. In the case of the crankcase and cylinder blocks, this is necessary, owing to the large number of operations on these parts and the amount of space required for the machines. Approximately, however, the lines of manufacture are parallel across the

Fig. 2—Type of electric truck now in use at the Continental factory

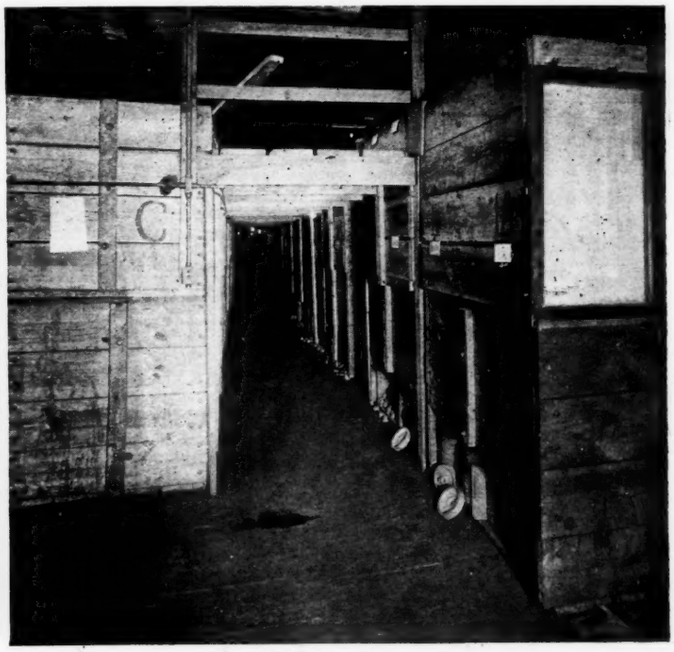
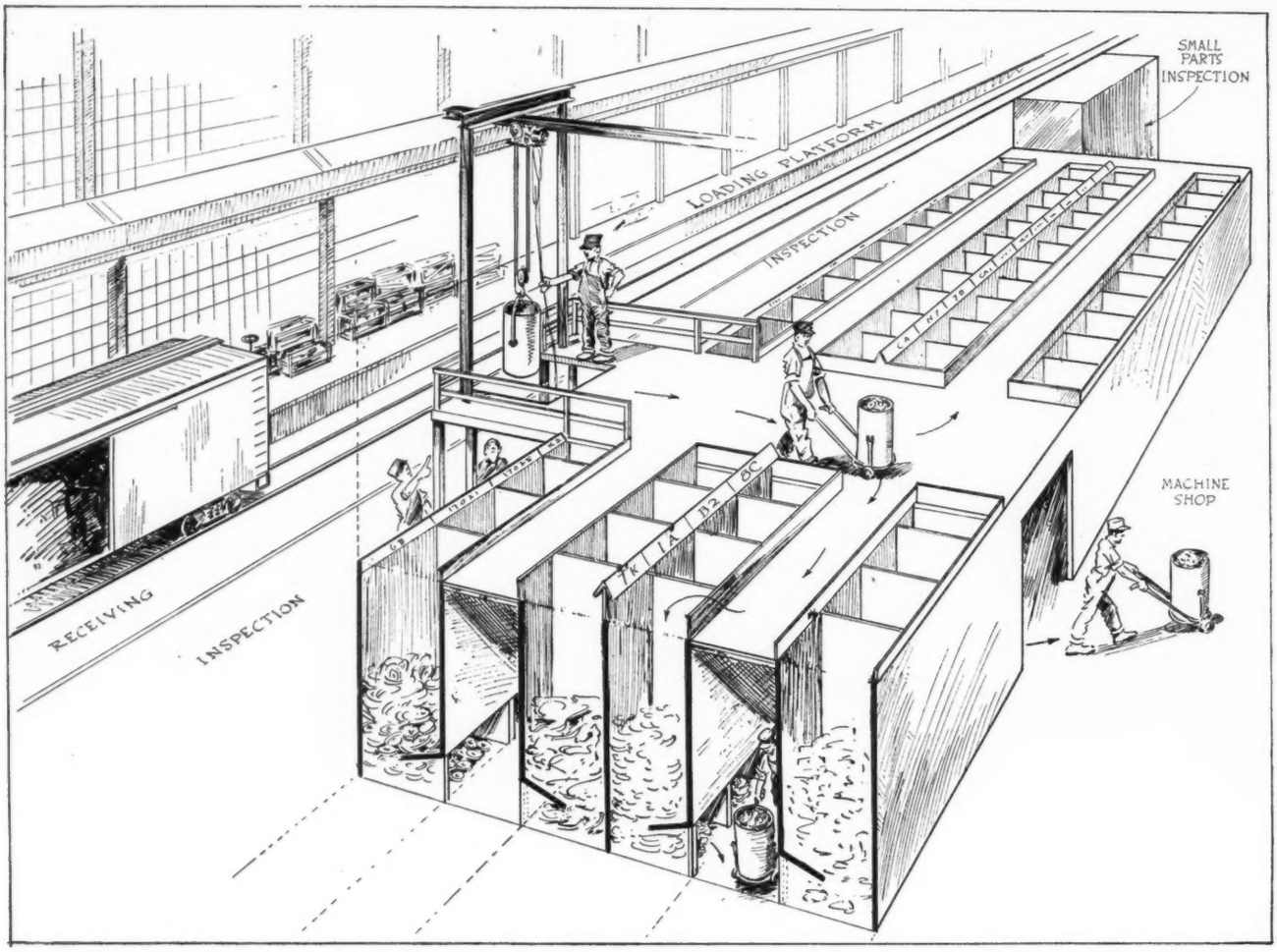


Fig. 3—Gravity-fed stock bins for small parts. These bins are filled from the loading gallery above



Section through the rough stock bins at the Continental plant, showing how the parts are hoisted from the receiving platform and sorted. They are withdrawn from underneath as required for the machine shop

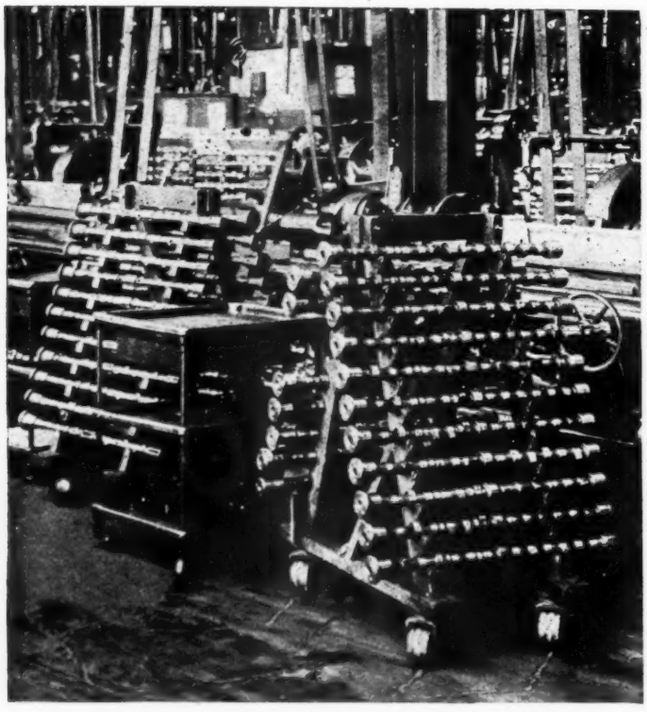


Fig. 4—Camshaft carrying racks in the finished grinding department of the camshaft floor

Fig. 5—Crankshafts in finished stock; also type of rack used for handling crankshafts in the grinding department

plant. One line will take flywheels; the next, crankshafts; the third, valves and tappets; the fourth, camshafts; the fifth, the flywheel covers; then there are two or three rows for the crankcases, cylinder blocks, sheet metal parts, manifolds, pistons, etc. These are the principal lines of manufacture and follow one another about in the order given, across the plant.

An effort is made to keep everything off the floor. Everyone who is familiar with engine manufacture remembers the piles of camshafts which used to lie upon the floor of an engine factory. A much neater way of handling this is by the use of racks. Fig. 4 shows a large number of these racks in the camshaft department. As may be noted, these racks are on wheels so that they can be pushed along from one machine to another, as desired. The racks handle twenty-four camshafts at a time in a neat and clean manner, and, being readily movable, a great amount of handling is eliminated by their use.

The type of rack used for handling crankshafts is shown in Fig. 5. This is a wheel type of rack, used in the departments where the crankshafts have to be moved about. It is capable of handling fourteen crankshafts and is of particular value in the grinding department and on the assembly floor where the shafts are moved along with the engines.

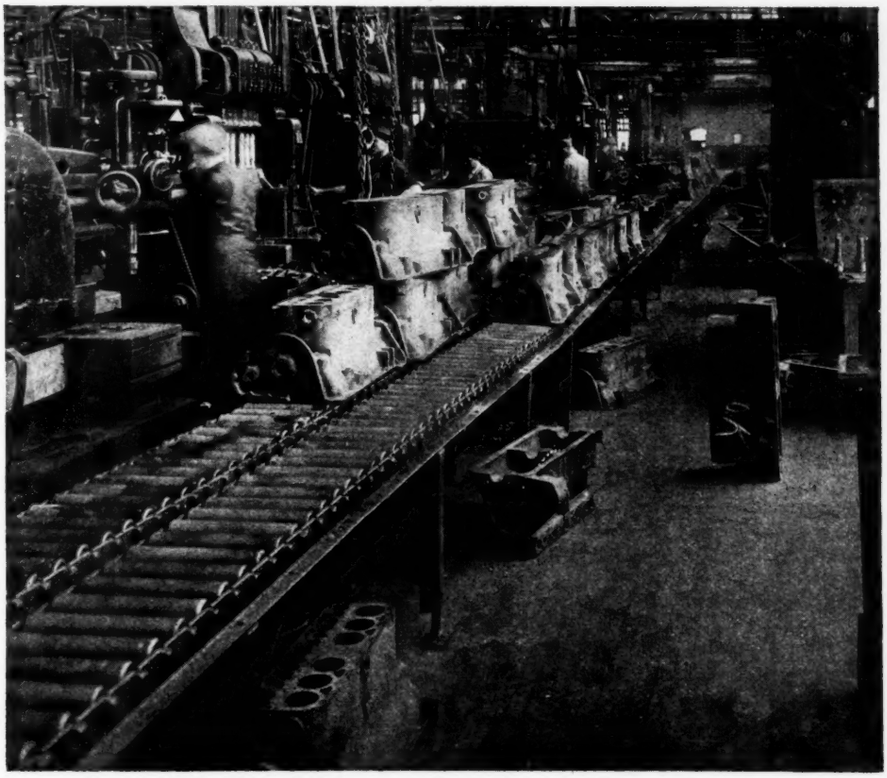


Fig. 6—One floor of the Continental cylinder boring department, showing type of carriers for handling cylinders. This railroad extends from the first operation in the cylinder department through the cylinder grinding department and connects with the conveyors in the assembly

Another type of crankshaft rack, without wheels, is used in storing the crankshafts, as the racks are very compact and result in very little waste space when they are used. Handling of the material through the manufacturing department is primarily accomplished by roller

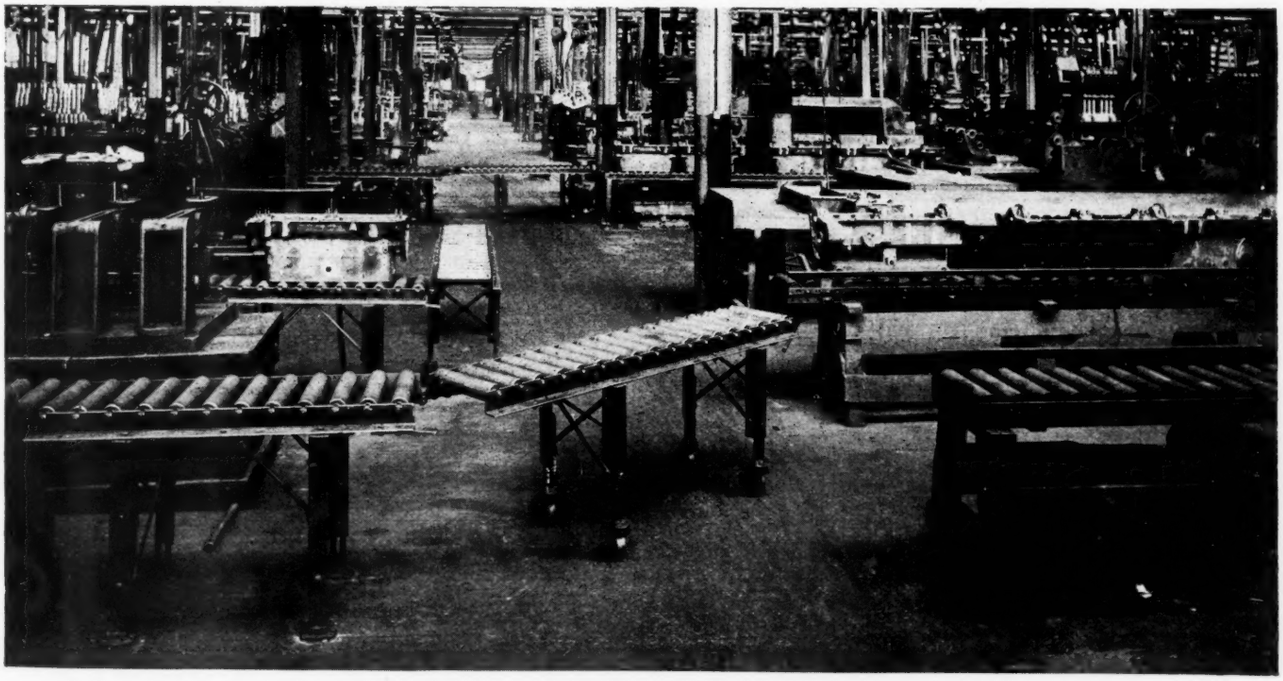


Fig. 7—General view of part of Continental machine shop, showing method of installing ball-bearing carriers where they cross the traffic aisles

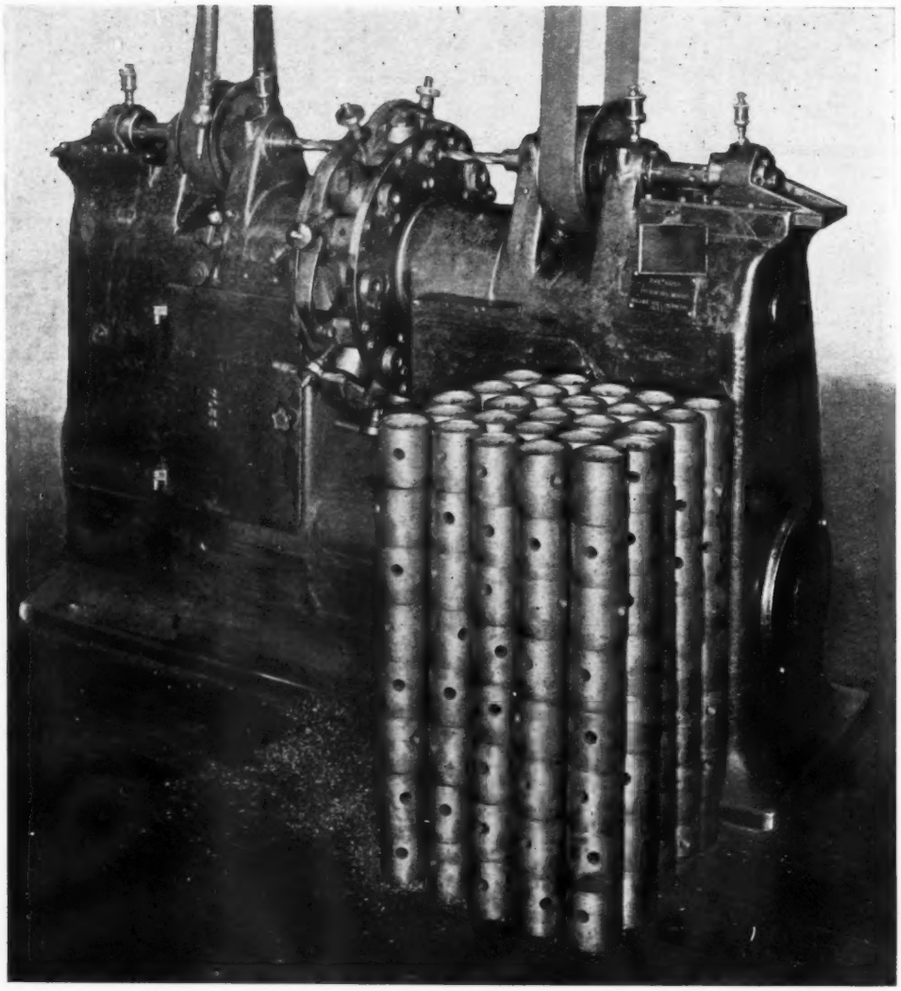


Fig. 9—Machine which drills the holes in the piston for the piston pin. These holes are drilled from each side. Machine takes eight pistons at one time

conveyors. For assembly, special types of racks, which will be explained later, are employed. The roller conveyor, however, is used to transport the materials from machine to machine, and, as will be shown in Fig. 7, a double row of these is used to handle the heavy parts upon which there are a great many operations requiring two or more rows of machines across the plant.

Fig. 6 shows the cylinder blocks working along the roller conveyor, and in this photograph they have just reached the boring department. In making use of these roller conveyors across the plant, naturally some provision has to be made for crossing the aisles, and this is done by ball bearing carriers or switch-overs, illustrated in Fig. 7. These can be swung across the aisle when necessary and are readily pushed out of the way should passage be required. They are hinged at one corner so that they are always in alignment when swung into place.

The railroad or roller conveyor system for the cylinder blocks extends from the first operation in the cylinder department through all of the boring, drilling, reaming, tapping and other cutting machine departments, to the cylinder grinding departments and finally connects with the conveyors in the assembly.

The progress along this railroad is really the determining factor in the timing of manufacture through the plant; in fact, the milling operations at the beginning of the cylinder and crankcase manufacture are the vital elements in determining the plant timing.

It is not the purpose in this article to describe, step by step, the manufacturing processes employed in making the Continental engines, as these follow conventional lines, except for a few important departures which may be pointed out as we make a brief trip through the manufacturing department before we see how the assembly works its way around to practically the point at which the engine started.

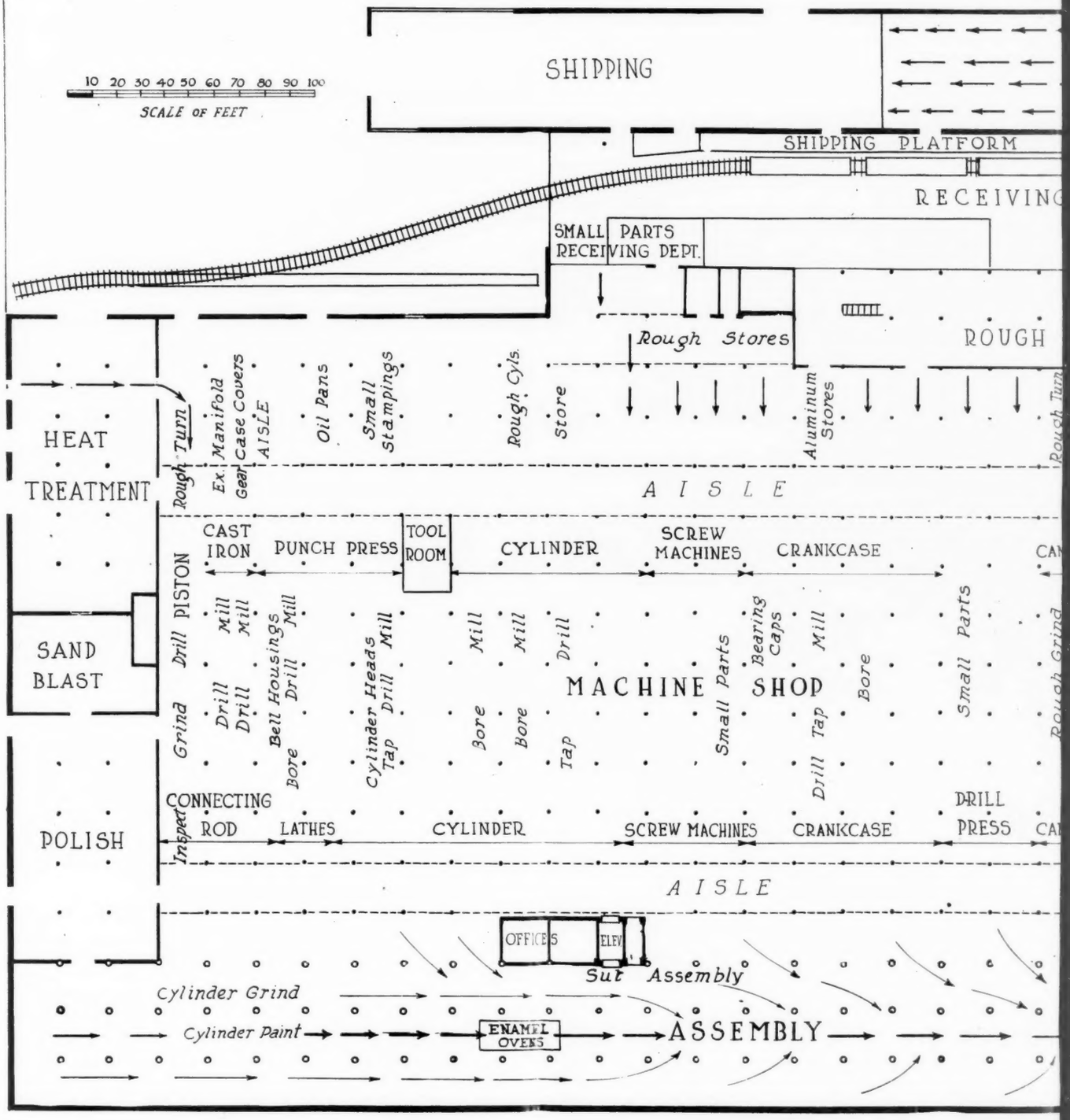
The piston department is of great interest because of the large number and variety of pistons sent through the plant every day. One of the interesting machines in this department is that for drilling the holes in the piston for the piston pin. As will be noted, the pistons are held in the circular fixture which is a part of the machine. The drills enter from both sides, simultaneously, and the machine is capable of handling sixteen of these pistons per hour. This gives a semi-automatic machine and is capable of handling the pistons for any engine, as the holder can accommodate pistons of various sizes and is easily set up. This machine is illustrated in Fig. 9. *(To be continued)*

A New Swiss Motor Plow

A COMBINED tractor and plow has been developed by the Swiss Locomotive & Machine Co. of Winterthur. The plow and motor are mounted upon the same frame, which is carried upon three wheels. The motor is an internal-combustion engine of 30 hp., suitable for light or heavy gasoline. A two-cylinder heavy-oil motor cannot be employed, owing to the scarcity of heavy oil. This motor drives the two front wheels through a shaft with differential gearing in a dustproof casing, and ball bearings are provided.

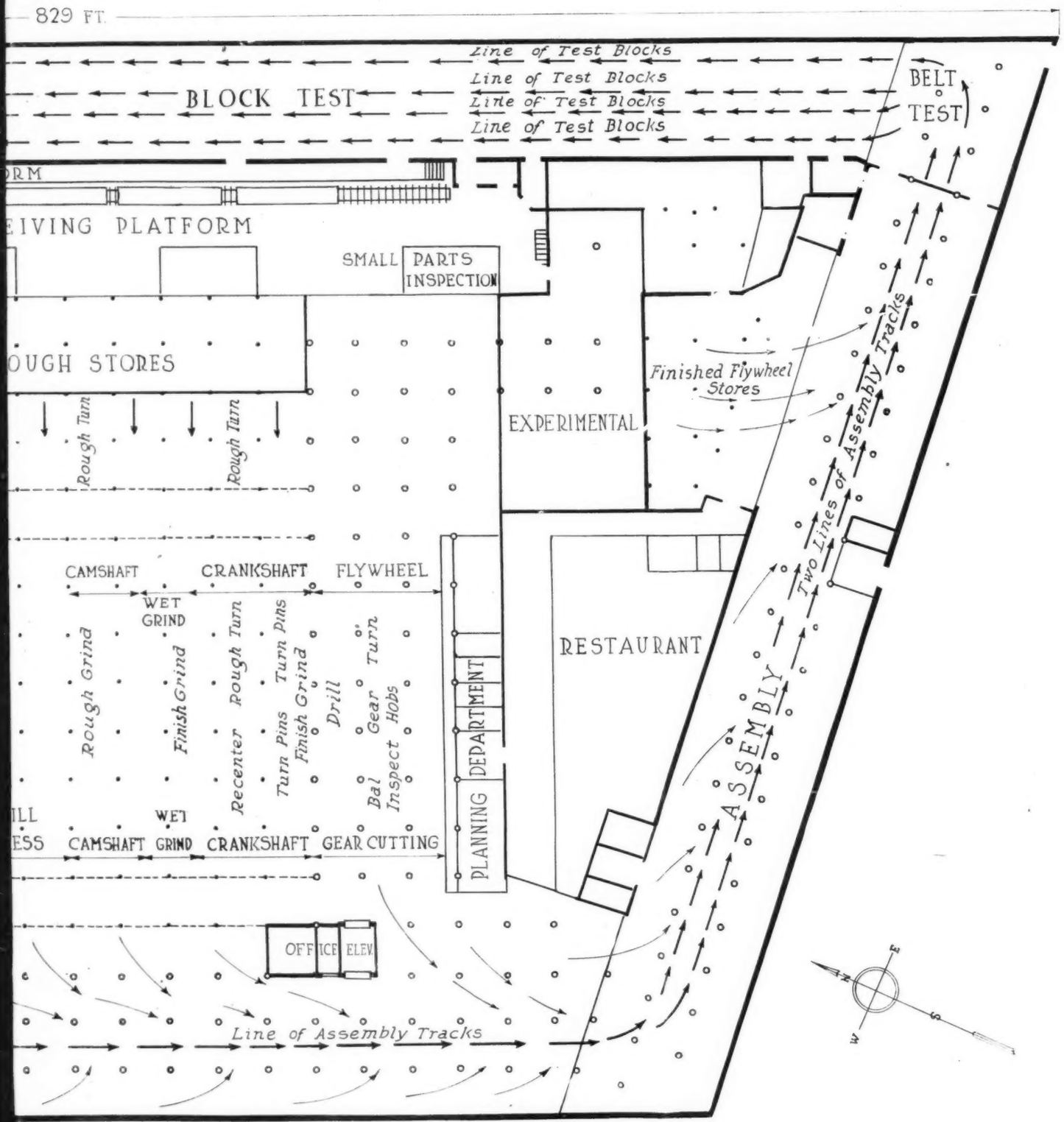
The wheels have flat strakes fixed to the rims and angle-iron lugs are bolted on for plowing. All three wheels travel on the unplowed land. The plow is a three-bottom type and the framework has a certain amount of free motion independent of the motor portion. The whole apparatus can be managed by one man. When the plow is disconnected the remainder can be used as a tractor or as a stationary engine.

The chief dimensions are as follows: Driving wheels, 63 in. diameter; third wheel, 29.5 in. diameter. Total length with plow attached, 18 ft.; breadth, 6.9 ft.; height, 6.2 ft.; weight, 6150 lb.; speed forward, either 1.7 or 3.75 m.p.h.; weight of the three-bottom plow alone, 1320 lb.; width of three furrows, 42 to 46 in. and depth of furrow, 6 in. to 14 in. The engine consumes 0.66 lb. of gasoline per horsepower hour and runs at 800 r.p.m.



Plant of the Continental M

Showing distribution of machining operations and relation of the various departme



ntal Motors Corp., Detroit

departments forming a progressive system beginning and ending at the freight cars

Improved Oil-Pressure Regulation in Liberty Engine

Early Engines Tended to Overoil at Low Speeds

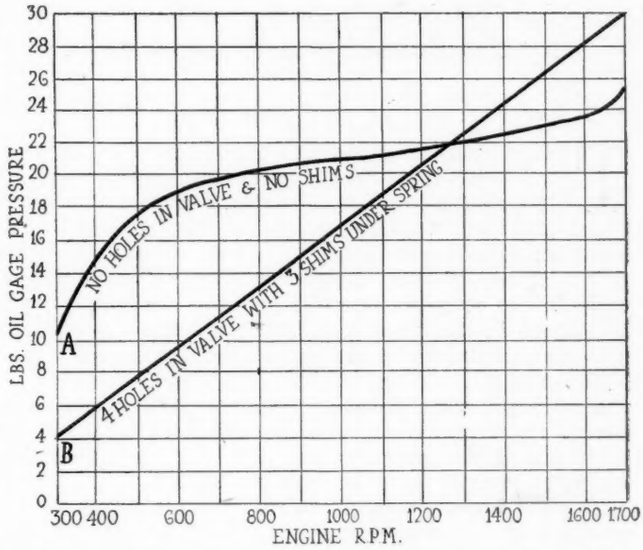
THE original design of undrilled release valve on the Liberty engine pressure oil system gave pressure results at the various engine speeds as indicated by curve A on the accompanying chart.

This shows that the oil distribution was not properly related to the engine requirements at various speeds and a tendency to overoil at the lower speeds resulted, this tendency being most marked when making a long glide with the engine turning at 800 to 900 r.p.m. and the throttle fully closed. To correct this in the simplest manner possible, four positive bypass or leak holes (No. 52 drill) were drilled through the relief valve, resulting in lower initial pressures and a curve building up more nearly in step with the engine speed. All engines are now adjusted to give 28-32 lb. pressure at approximately 1700 r.p.m., the oil at a temperature of 65 deg. C. (212 deg. Fahr.) (Liberty Aero Oil Specification No. 3501).

This adjustment is obtained by means of shims 1/32 in. thick, inserted under the relief valve spring, and from two to four of these shims will be necessary, depending on the fit of the engine bearings, the pump gear clearances, etc. Shims may be readily manufactured at the fields, or common iron washers can be secured to answer the purpose.

The later engines show 28 to 32 lb. pressure at 1650 to 1750 r.p.m. (see curve B) when thoroughly heated up by ½ hr. of 9/10 to full power flying at an altitude of 3000 to 6000 ft. with water temperature approximately 75 deg. to 85 deg. C. (165 deg. to 180 deg. Fahr.) and with average air temperatures. Ordinarily three shims will accomplish this, and, of course, the pressure will be much higher when starting out with the engine and oil only moderately warm. It may also drop somewhat lower after 2 or 3 hr. in the air, particularly if the supply gets a bit low.

If oil of higher viscosity than Standard Specification No. 3501 should be used, a smaller number of shims is required, but in no case should less than one shim be inserted. Because of the shape and location of the oil tank in the DH-4 the oil often gets up around 90 deg. C. (195 deg. Fahr.) and it will average 65 deg. C. (150 deg. Fahr.). Consequently, it is never safe to allow the supply to get lower than 6 qt., and 8 is better as a minimum. When the supply gets lower than 6 qt., it passes through the engine bearings so many times per minute that it has not sufficient time to cool and soon breaks down, resulting in damaged or burnt-out bearings.



Oil pressure chart with and without shims under valve spring

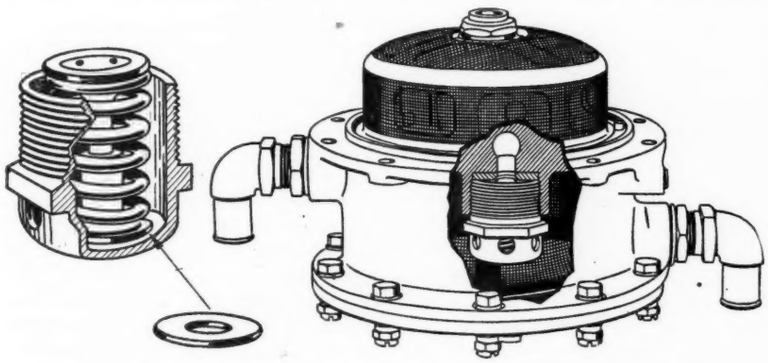
Naturally a high-viscosity oil stands up better under such punishment.

Where unusual difficulty is encountered in getting the pressure to hold up, one of the four leak holes can be plugged with a drop of solder, but this is very bad practice, since it raises the pressure too much at the gliding speeds and the plugs are almost sure to foul on a long glide with closed throttle.

On engines equipped with the hydraulic CC type of synchronizer, the cock in the line between the pressure gage line and the synchronizer must be closed when testing oil pressures. Ordinarily this cock should be opened only at intervals for a few minutes, to give the synchronizer an extra oiling, but if the guns are used excessively it may be necessary to leave the cock open when flying. In this case the pump should first be adjusted and tested as outlined above and then one leak hole plugged with solder. This is necessary because the oil in the cock is practically equivalent to one of the regular holes, and four is the maximum number that should be used. Adjustment, however, should not be made with cock open and the leak hole plugged, because the gage does not register accurately when the pressure line is being "bled" by the synchronizer feed through the open cock. Engines fitted with the Nelson synchronizer or mechanical interrupter do not have a feed of this kind, and the gage registers correctly under practically all conditions.

In cold weather difficulty will be experienced with lubrication unless full precautions are taken. Use hot oil and boiling water. Do not exceed 800 r.p.m. as a steady warm-up, although the motor can be accelerated and slowed down to throw oil up into the cylinders. Cold

(*Continued on page* 1138)



Assembly of the oil pump cut away to show the relief valve. The enlarged view of the relief valve at the left shows the two leak holes and the shim under the spring

Strong Tendency for Co-operation in Labor Ranks

Willingness of a Majority of Actual Workers to Join with Employers in Adjusting Differences and Adapting New Conditions Has Been Overshadowed by the Sensational Programs of the Radicals, Who Wish Only to Rule

By Harry Tipper

THE growth in the adoption of systems involving the combined action of management and employees upon the questions of wages, hours and other matters which affect the working conditions, has attracted less attention than the actions of the radicals in labor and the existence of excessive demands which have their basis in the program of the irreconcilables, which was mentioned in last week's article. The attention which has been accorded to the unrest among the working bodies, and the success of the radicals among labor organizations in some localities in forcing strikes, is due in part to the change in the point of view brought about by the war and the general expectation that conditions will not go back to the pre-war organization entirely.

The vociferous demands of the radicals in labor organizations have affected the outlook of the conservative labor leaders and the affiliated organizations of labor, to this extent, that they must recognize the unrest that exists in their own ranks and the necessity for some action, where this action is not entirely destructive of the affiliated labor organization ideals. Because of these conditions there has been a general tendency to confuse the demands, which have originated with the radicals within the labor ranks, with the demands of the affiliated organizations as such. This has led many manufacturers to condemn the viewpoint of all labor in its organized endeavors, without studying the question and without realizing the conditions which exist within the labor organizations, and the fact that the leaders themselves are obliged to compromise between the conservative opinions and the radical demands within their own ranks.

Real Objects of Organization

As these matters are chronicled in the daily press and in the general publications, no distinction has been made between the objects of organizations such as the I. W. W. and the objects of the regular affiliated unions as such. It is true that in several localities within the last six months the radical part of labor opinion has been able to assume command of the local situation and to start general strikes, against the desires of the more conservative of the labor body, practically assuming control of all unions by taking advantage of the existing machinery of labor organization and diverting it to their purpose. These movements are not countenanced by the older and wiser heads in the occupational labor unions, and they can be discounted to some extent as a natural result of present conditions, particularly the restlessness and demand for expression which were not visible before the war period.

On the other hand, the growth of combined bodies within the individual industrial organization itself, by which manufacturer and employee can have equal representation in the matter of wages, hours and other working conditions, indicates a development of constructive thought and study upon the problem of human relations in industry that is far more important in its suggestions of future growth.

The whole program of the radical within the labor organization is destructive. It aims at sweeping away the present system without any constructive idea of how it is to be replaced. The more conservative and moderate members of the labor organizations and their leaders understand very thoroughly the futility of such a program, and the final result of any attempt to progress materially in that direction.

A somewhat similar condition exists among manufacturers and employers and those having control of industrial operations. The more moderate, studious and farsighted of such organizations are developing plans whereby the manufacturer and employee shall determine the conditions of work in co-operation with each other on the theory that it is the right of the employee, and the duty of the employer, to give the worker some adequate voice in the government of his own working conditions. There is a considerable section of opinion in financial and manufacturing circles, however, which still believes that it is possible to continue industrial organization on the same basis as it has been developed for years, and who see no value in any suggestions for change or even in any discussion of the subject.

Too Much Attention for Radicals

Unfortunately, the minority of radicals in the labor organization succeed in securing a majority of the attention, and similarly the views of those employers who see no value in anything but the maintenance of the old system of supply and demand are widely heralded, while the desire of the majority of manufacturers and those in control of industry to deal fairly with the matter on any adequate basis receives little or no attention. It is this feature of the situation which is somewhat disturbing. Despite general strikes in some localities, and the statements of some of the radical labor leaders, there is evidence that the extreme opinion in labor circles is the opinion of a very small proportion of the total body of labor only. Comparatively few of those in control of industry will be willing to subscribe to the platform erected by the few who have received public attention because of the strength of their denunciations and the positiveness of their position. For the most part, however, the moderates on both sides are inarticulate, and they are receiving their impressions as to the general opinion of the other side from the radicals, who are bound to develop their own program, and that only.

In the last two months in not less than 20 or 30 cases,

manufacturers have quoted to me the extreme statements of one of the irreconcilables among labor leaders and insisted that this represented the general platform of labor as it is organized in this country. Similarly a number of labor leaders have quoted the extreme statements of some of the manufacturers and have stated that nothing could be expected from bodies who held such opinions, intimating that this was the general platform upon which the manufacturer stood.

It is perhaps only the student who will patiently gather together all the records in the case. For him the situation presents elements of constructive progress that cannot be overlooked. When the manufacturer states that there is no satisfying the worker and that nothing will avert a strike, the mind reverts to the 12 or 14 cases recently recorded where the workers in an individual plant have refused to join the general strike in which their occupation was concerned. Everyone who has any interest in industry, whether from the employers' or the employees' point of view, has read of the serious strikes in the textile industry at Paterson, N. J., and of the demands of the workers, but few people know that in one large plant not a worker left his work during the strike.

Decisions of Employees Themselves

In New England, when the skilled mechanics were demanding more pay and less hours, a plant referred the question of a reduction in the number of working hours to its employees, the reduction being necessitated by the conditions of the business, and an agreement was reached to reduce the week to 4 days without any trouble.

When the labor leader insists that there is no hope of securing a fair deal from the manufacturer and that labor must force its program through in order to control the situation, the mind is immediately confronted with the records of at least 20 plants where the workers have not only refused to strike but have entirely altered their viewpoint upon wages and hours, and have testified to their faith in the square dealing of the concern by their decision on almost every possible point which might arise.

The fact that these things are occurring and are demonstrating in these individual plants the workings of cooperation between employer and employee in the settlement of working conditions is the most encouraging sign in connection with industrial organization and production development in the near future.

Ordinarily our perspective is so warped by the attention to the differences, by the desire for the sensational and the fact that things are ordinarily understood to be interesting only as they record a fight, that we are in danger of assuming a condition of affairs which does not exist, and basing our opinion and actions upon those assumptions, whereas in reality they should be based upon a different conception entirely. The future solution of this question cannot be helped by the opinions and actions of the vociferous irreconcilables on either side, who can see no possibility of value in any other program than the one which they have laid out.

Solutions for Present Unrest

Of the two, the labor irreconcilables are the most dangerous, because they would substitute for present organization, which is at least of some value, experimental organization, the value of which has not been demonstrated and which on its face does not appear to have any elements of constructive possibility. The man who is in control of industry, however, and who refuses to discuss, study or consider the question of the worker's aspirations, his point of view and his necessities is in almost as bad a position, because he cannot offer anything which will solve the present unrest, and the history of the matter shows that warfare has not decreased as industry has grown.

The work which has been done by many organizations, some of which are the largest and most important in their fields, in meeting this question of industrial relations in a reasonable and moderate way is encouraging because it indicates the practical possibility of such steps. It has gone far enough to show the practical working out of such methods, and it has been in motion sufficiently long to prove that no serious calamity necessarily accompanies the change.

The minority radicals on both sides can be reinforced into a majority only if they are allowed to govern the opinion and the action of the moderates. This is due to a general misconception as to their place and standing. If the moderates among the manufacturers are willing to adopt practical means of adjustment, will take the time and effort to study the opinion, the point of view of the workers, whether in the shops or the offices of their organization—if they will examine the changes which have been made by important and stable concerns in their endeavor to deal with the question and act upon the result of their thorough investigations, there is good reason for hope that industrial organization in this country will take a long step in advance and provide a stability which has not been secured in any other country, and which cannot be secured under present conditions.

Training Helps Workers to Help Themselves

THREE-FOURTHS of the industrial workers in America are handicapped by lack of proper training in their respective tasks, according to the U. S. Training Service of the Department of Labor. The work of the Service is to increase the efficiency of this "insufficient three-fourths," rather than to stimulate the output of the one-fourth already producing at a satisfactory rate, says a bulletin, "Some Advantages of Industrial Training," now being distributed by this branch of the government.

Bringing about a big increase in output of the average plant, the government contends is wholly within the possibilities, if the following steps are taken: (1) A careful analytical survey of the operations in the plant to ascertain where existing methods can be improved; (2) the formulation of a definite program of training, either in a separate department or "on the floor" in direct conjunction with production; (3) the instruction of those workers who are most in need of it and (4) the upgrading of those in the next higher strata. A training department helps workers to help themselves.

Another question of keen interest to the workingman and the employer alike, taken up in this booklet, is the effect of training on labor turnover. It points out that the turnover for the country at large is at least 250 per cent., placing an annual burden of $1,250,000,000 on our manufacturing industries. Basing his claim on the experience of several score of plants where training has been installed, the author maintains that such instruction in a factory causes a big reduction in turnover. The trained employees can more readily find suitable work and are more easily retained in a plant. Training contributes to a better spirit among employees and develops better teamwork with the employers.

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The AUTOMOBILE

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Congressional Action Needed for Commercial Aviation

THE need of prompt Congressional action in developing regulations for commercial aviation in the United States was emphasized by the announcement of the Army Air Service to the effect that it will establish air routes between, and landing fields in, certain cities.

Military authorities cannot visualize commercial requirements. In the selection of cities and the construction of fields they will naturally be guided chiefly by military requirements. Sites will be selected more because they conform to the military plans for defense rather than because they fit into a logical scheme of development for commercial aviation.

It has been announced that the fields are to be constructed through co-operation with the municipalities in which they are to be located. It seems likely that this co-operation will be easily secured, as the advantages of commercial aviation will be readily appreciated. It is feared, however, that those who co-operate in this way are likely to experience disappointment and discouragement when, after expending large sums, they find that what they have helped to build is more suited to military than to commercial usage. If this result follows, commercial aviation will receive a setback.

The selection and construction of landing fields for commercial aviation should not be left to military authorities. They should, of course, select and build fields necessary in the system of national defense, but their activities along this line should be generally understood to be purely military.

Congress, at the next session, as one of its first acts, should enact legislation which will place the regulation and control of commercial aviation under either a new department of aviation or in the hands of one of the existing departments accustomed to co-operate with industry and commerce. Because of the importance of this latter consideration, the bill to be presented by the Department of Commerce should be given special attention.

Export Trade Demands Common Sense

THIS matter of export trade is neither mysterious nor complicated. It is a simple business proposition and demands chiefly common sense.

It calls for analysis and caution and perspective to exactly the same degree as these are exercised in domestic trade. There appears to be more anxiety than is necessary merely because of a widespread notion that export trade is a complicated affair, requiring complicated handling.

No automobile manufacturer planning a campaign in a local section of the United States would start without first considering the field, the wealth, industrial and social conditions, highways, character of the people and other essential factors. He would not fix an appropriation without a study of the possibilities of business. He would not ask an artist, never west of the Hudson, to paint a sketch designed to have local color for an advertisement in the Rockies. He would not employ a sales representative for California merely because he was born and reared there or had traveled through the State as a Pullman conductor. He would not employ local New York idioms in an advertisement intended solely for Oregon.

And similarly in the development of export business, it is first essential to study the field comprehensively, build the advertisements to fit the customs, conditions and people, spend sums conforming to the business possibilities, employ artists who know the localities, write the publicity in the native language of the people and appoint sales representatives who know both the people and the commodity or a kindred product.

It is a matter of doing business in foreign countries with the same common sense that is exercised in this country.

The Day of the Inventor and Designer

NOT for a long time have the inventor and designer occupied such important positions in the automotive field as they do to-day. Many have complained that our industry has focused its attention on production and price to such an extent that it was almost impossible for a man with a new idea to get a hearing unless that idea had something to do with shaving a few cents off the cost per car.

There are numerous instances where inventors have been placed under contract, the seal of silence placed upon them, handsome salaries paid to them and their inventions never used. They were kept silent because while those who employed them realized the importance of their inventions, they did not want to upset production or undertake the work of selling something new.

Conditions are different now in many but not all the factories. It is recognized that next January's New York Show will disclose radical departures made by many of the oldest established concerns. We know of one concern that has contracted for thousands of engines of a radically different type from those now in use, provided certain specifications can be met. And according to all advices these conditions are not only being met but will be far surpassed. Another car manufacturer is on record as about to abandon the poppet-valve engine for one with a valve design of different type.

There are literally hundreds of new things in the factories and on the roads that will make their appearance next year, and knowing this the manufacturer is more ready to try out inventions and plans that look feasible than he has been since the early days of the industry when mechanical progress was marvelous in its rapidity.

This is a healthy state of affairs. With the fuel problem before us, with the demand for performance, economy and appearance more firmly impressed on us than ever, and with the knowledge that the markets of the world are open to us as never before, inventions which better the product should be given careful consideration. The countries which were involved in the war were jogged out of their mechanical and engineering rut by war's necessities, and it is but natural that in returning to peace pursuits they will make use of their added knowledge and stimulated initiative.

There has been much complaint in the past on the part of inventors that their work was not properly appreciated. There may have been justification for this plaint, especially in times of unusual prosperity when everybody was busy and disinclined to experiment with new things. But there is certainly none now.

Industrial Devastation in Belgium

A REPORT on the wanton devastation of the automotive plants in Belgium will be printed in AUTOMOTIVE INDUSTRIES, beginning next week. The report was prepared by W. F. Bradley, European representative of this paper. Mr. Bradley obtained, after much difficulty, permission to tour Belgium and visit these factories to write a report and secure photographs exclusively for AUTOMOTIVE INDUSTRIES. He spent considerable time in these plants, noting the damage that was accomplished and gathering data as to how this was done and the extent of the damage, both to the physical plants and to the future trade.

Photographs accompanying this report are evidence of the thoroughness with which the German army and industrial leaders did this work. They continued the destruction until fifteen minutes before the Armistice became effective.

Practically all of the expensive motor building machinery in the Belgian factories is gone. Those machines which were available for use in the German war material factories or field repairshops were removed on official orders, but other machines were destroyed where they stood.

At the time this was under way, it was supposed that this was done chiefly to provide raw material for war manufacturing purposes, but Mr. Bradley finds that the present opinion is that this destruction of machines was planned and carried out with a view of eliminating Belgium as an automobile exporter after the war. This view is supported by the fact that Belgian factories were run chiefly for the export trade and were no mean competitor for the Germans.

Mr. Bradley's report is exhaustive and convincing and a document of importance as to German methods and objectives.

Latest News of the

Steps Toward Armistice in the Willys-Overland Strike

Settlement Is Expected by Monday—Company Explains Status of Controversy with Union and Its Bearing on Competition—Other Toledo Labor Disputes Moving Toward Settlement

TOLEDO, May 22 (Special Telegram)—An armistice in the Willys-Overland strike seems near at hand, and probabilities are that the men will be back on their jobs and the plant running smoothly on Monday. Many of the men who are returning to work are being deputized so they can carry arms to protect themselves.

Conferences have been held all week regarding the Willys-Overland affair, and both sides have agreed to settle the matter by arbitration. The union workers insist that they are not giving any ground by agreeing to an armistice and are threatening to withdraw all union funds from Toledo banks. This would amount to about $2,500,000. A further demonstration was held on Sunday, when thousands of workers, led by a soldier in uniform, marched in a parade through the city and held a mass meeting opposite the police station.

The settlement of other labor controversies here also seems near. Of the 800 strikers of the Edward Ford Plate Glass Co., 400 have returned to work and the rest, it is said, will be back the beginning of the week. The men are returning to their old wages and old hours.

—

TOLEDO, May 20—Vice-President and General Manager C. A. Earl of the Willys-Overland Co. said to-day that the Willys-Overland plant would be opened Monday morning.

In a page advertisement in the Toledo paper Saturday, Mr. Earl restates the position of the Willys-Overland Co. in the present labor trouble. He sets forth that the automobile district council, which presented the demands causing all the trouble, did not represent the majority of employees. Out of 13,000 men and women who were at work on May 5, more than 7,000 remained at their places after those employees represented by the council had walked out.

When the walk-out was decided at a mass meeting, May 3, the only point voted on at that meeting was the question of hours. Approximately 1200 men were present when the vote was taken. Less than 900 men, not over 7 per cent of the total employees of the plant, voted for the walk-out. As a result of the extraordinary action taken by this very small number, instructions were issued to walk out on Monday, May 5.

"In justice to ourselves and to the many thousands of our loyal employees," states Mr. Earl, "the company did not and cannot recognize the right of a small group of men to determine our policy, and to so vitally interfere with the inherent rights of 13,000 employees, without having in any way the authority to represent or act for them.

"It is well known that the Willys-Overland Co. has always operated an open shop, without discrimination against any man, whether he be a member of a labor union or not."

In taking up the demands as presented to the company on April 27, the company first quotes the demands of the men and follows with the statement of the company's position.

Establish 8-Hr. Day

Regarding hours, the strikers ask for an 8-hr. day and a 4-hr. Saturday for the first shift, and 8 hr. with no work Saturday for the second and third shifts. In discussing this demand, the company states that it is convinced of the reasonableness and justice of the 48-hr. week. In restoring the 48-hr. working week after the suspension of war activities, the company informed the committee that competitive conditions demanded that it continue to operate on the basic 49-hr. week.

To concede a 44-hr. basic week as against a 48-hr. basic week would mean decreasing the working hours per year equivalent to a month's output. Such a plan would mean a big loss in earnings to employees, as well as a big loss to the company.

While the 48-hr. week working basis was established in good faith and in the belief that the majority of employees want Saturday afternoon off, nevertheless the company is willing to abide by the result of the majority vote of its employees and divide the week into six days of 8 hr. each, thus fully establishing the basic 8-hr. day.

Settlement of Overtime Pay

Regarding overtime, the strikers demand that all time worked after the established hours shall be paid for at double time rates. No employee shall be required to work on more than one shift in any given 24 hr., unless they are compensated at the rate of double time for such work performed. The union wants double time on Sundays and all legal holidays; election and primary days shall be 7 hours. The union demands limited overtime not to exceed 2 hours per day and 3 days per week. They also request that no overtime demand be made upon them by the company between June 15 and Sept. 15, except in case of emergencies such as breakdown in machinery and equipment. In answering this demand, the Willys-Overland Co. declares double pay for overtime an unreasonable request, which could not be sustained under relative competitive conditions. The company is willing to pay time and a half after the regular hours established for the 48-hr. basic week. Double time will be paid on Sundays and on the days observed as national holidays.

Representation Plan

Regarding shop committees, the union demands that employees shall elect a committee of three members in each department of every plant. These committees are to be recognized by the company as being the proper representatives of the employees to take up departmental grievances with the foremen of any department wherein a grievance has arisen. If this committee is unable to adjust said difference or grievance with the foreman of the department, then the grievance with the foreman is to be turned over to the Joint Shop Committee and the proper officer of the company for adjustment. The Joint Shop Committee shall not exceed 15 members and shall be selected by the employees.

The Shop Committee shall be recognized as the proper representatives of the employees in adjusting trouble which cannot be settled by the department committee and their foremen. Members of the Joint Shop Committees will be allowed the privilege of investigating grievances in any department that are brought to their attention.

In reply to this demand the company informed the employees that it had already provided a plan of representation of all employees. This plan gives employees the right to elect their own committees, which will work in conjunction with the management in the settlement of grievances, wages and working conditions.

Under the company's employees' representation plan, committees are elected in the various departments or divisions on the basis of one representative for each 200 or 300 employees. From the ranks of these elected committeemen five employees are elected by the committeemen themselves. The management also appoints five representatives. These ten men constitute the general board of adjustment to handle all matters which can-

(*Continued on page* 1137)

Automotive Industries

Bill for Maintenance of the M. T. C. Introduced in Congress

Army Officials Urge Its Continuance as Separate Body—Work of Corps Commended by Gen. Pershing—Bill Provided for Disbandment of M.T.C. in Last Session

WASHINGTON, May 20—With the opening of Congress this week, considerable interest centers about the future of the Motor Transport Corps, the continuance of which as a separate body in control of the operation, maintenance and purchase will be urged by army officials. During the last session the army bill provided for the disbandment of the M. T. C. and the return to the old system under which the control of trucks and other motor vehicles would be placed under each separate division. This plan was followed prior to the war, when the Quartermaster Department, Signal Corps, Aviation, Engineer and other divisions each purchased and maintained their own supplies of motor vehicles, with a certain amount of confusion, conflict and a needless waste of labor. Amendments were made to the bill, however, by Congressmen who realized the value of maintaining the corps separately. The filibuster prevented its passage.

The consolidation of the motor interests in the M. T. C. as a separate organization eliminated the duplication of effort and tended to insure a standardization of army vehicles. It is planned to introduce a bill in this session which will continue the M. T. C. as a separate division and place the maintenance, design, production, procurement and operation of bicycles, motorcycles, cars, trailers and trucks under it and leaving tractors and tanks under the control of the Ordnance Department.

Army officers point to a recent letter received from General Pershing by Brig. Gen. M. C. Walker, in which General Pershing testifies to the efficiency of the M. T. C. as additional evidence of the need for a separate division.

It is anticipated that there will be some controversy about the continuance of the M. T. C. due to the fact that executive divisions of the War Department are planning to maintain the present control of the purchase of motor vehicles.

Following is the letter from General Pershing to Brig. Gen. Walker and the proposed bill which will make the M. T. C. a permanent organization:

"Brig. Gen. Meriwether L. Walker,
Director, Motor Transport Corps,
American E. F., Tours.

"My Dear General Walker:

"At this time when many officers and enlisted men are returning home and severing their connection with the American Expeditionary Forces, I am glad to take the opportunity of expressing to you, and the officers and men under you, my appreciation and thanks for what the Motor Transport Corps has accomplished.

"When war was declared, motor transportation was almost non-existent in the army. From the outset, the Motor Transport Corps had to meet the most difficult conditions, including its organization at a time when the demand for motor transportation at the front was the greatest; it always suffered from a deficiency of at least 70 per cent in required personnel and of 50 per cent in needed material. The handling of many different types of motors which had been ordered and shipped to France by the various services, combined with an entire inadequacy of spare parts, was another difficulty that had to be overcome.

"That the Motor Transport Corps was able to operate despite these handicaps and keep enough vehicles running at the front to supply the fighting troop speaks well for the energy and perseverance of your officers and men. Under all conditions of weather, on bad roads, often under heavy fire, at the front and throughout France, they labored cheerfully. Your well-considered plans would have soon borne fruit and resulted in a highly efficient service.

"In ending I cannot neglect the opportunity of thanking you personally for the energetic effort and enthusiasm you have displayed in your difficult task and which produced such fine results.

"Sincerely yours,
"JOHN J. PERSHING."

Section Referring to M. T. C. Provisions

The following is the section of the General Army bill for 1920 that refers to the M. T. C.:

For contingent expenses for Motor Transport Corps operations in the field, purchase of the necessary articles of office, toilet, desks, furniture, stationery, ice and water for office use when necessary, binding, maps, technical books of reference, professional and technical newspapers and periodicals, payment for which may be made in advance, and for other purposes incident to the Motor Transport Corps, services and expenses of necessary employees engaged in the Field Service, provided that the number of and total paid for civilian employees in the field service of the Motor Transport Corps shall be limited to the actual requirements of the service.

Provided, further, that the Secretary of War is hereby authorized in his discretion to rent or lease any building or part of building in the District of Columbia that may be required for the Motor Transport Corps during the fiscal year ending June 30, 1920, payment therefor to be made from this appropriation.

Provided, further, that the service of skilled draftsmen, expert automotive engineers, mechanical engineers and such other services as the Secretary of War may deem necessary may be employed only in the office of the Chief of the Motor Transport Corps to carry into effect the various appropriations: Provided, that the expenditure on this account for the fiscal year 1920 shall not exceed $428,710, the Secretary of War shall in the annual estimate for the fiscal year ending June 30, 1922, report to Congress the number of persons so employed, their duties, and the amount paid to each.

For maintenance of the necessary automotive vehicles of the army including repairs, spare parts, etc., operation of motor vehicles, including gasoline and lubrication, hire of automotive equipment when necessary, maintenance of repair shops and units and other purposes in connection with design, production, procurement, housing, storage, maintenance, repairing, operation and replacement of Motor Transport Vehicles for the Army including accessories and mechanical supplies, no part of which to be expended for clerical employees in any capacity.

Provided, further, that in this act the term Motor Transport Vehicles wheresoever used will be construed to mean all bicycles, motorcycles, automobiles, trailers and trucks, that are fitted or may be fitted for passenger or cargo transportation. Tracklayer tractors, designed primarily for traction purposes, and tanks are not held to be Motor Transport Vehicles.

Provided, further, that the Motor Transport Corps shall be charged with design; production; procurement; housing; storage; maintenance; repairs; operation; assignment and replacement of all Motor Transport Vehicles; spare and repair parts; tools; accessories, and mechanical supplies of all Motor Transport Vehicles for the Army as hereinbefore described. Provided, further, that the Motor Transport Corps shall under such regulations as may be approved by the Secretary of War, establish and operate such garages, parks, depots and repair shops as may be necessary and to procure, organize, assign and technically train all persons necessary to the proper operation thereof.

Provided, further, that the procurement of Motor Vehicle chassis required for carrying special type bodies for the Army will be made under the direction of the Chief of the Motor Transport Corps.

Provided, further, that the procurement of special motor vehicle bodies not designed for passenger or cargo transportation or for Motor Transport purposes, and tracklayer tractors and tanks as hereinbefore described may be made under the direction of the bureau, corps or department for which such special equipment is designed.

Provided, further, that the procurement of special motor vehicle bodies shall be made only after the design thereof is approved by the Chief of the Motor Transport Corps.

—

N. A. C. C. to Make Formal Request for Reclassification of Chassis

NEW YORK, May 21—The National Automobile Chamber of Commerce is preparing to make a request that the revenue tax be removed on automobile parts and trucks. Representation is to be made to-morrow before the Internal Revenue Department for a reclassification of the truck chassis so that it will not be classified as a part and thus subject to 5 per cent tax, but will be classed as a complete vehicle and subject only to the 3 per cent tax.

The Chamber will hold a meeting of its export managers on June 6 for the purpose of mapping out a definite foreign trade program with the possibility that some form of foreign trade co-operation, as made possible in the Webb Act, may be worked upon.

—

Goodwin Leaves Cadillac

DETROIT, May 21—Edward W. Goodwin, engineer of the body division of the Cadillac Motor Car Co., has resigned. He will take a month's rest and then open an office here for car designing, detail and building.

Great Britain Developing Commercial Aviation Program

Large Military Air Force Maintained—Manufacturers Continue Activities—Commercial Enterprises Starting—International Air Rules Modified at Paris

LONDON, ENGLAND, May 1—The Government is conducting its military aerial program with the greatest secrecy. Not much positive information can be gained. While the demobilization of the army continues, the air force is remaining at the same figure as when the armistice was signed. The present force is believed to be 40,000 officers and 310,000 men. This means that Great Britain will continue indefinitely a large air force. The commercial aircraft manufacturers are continuing activities. None of the larger firms have slackened work, although many of the small ones have. But very few have closed down.

Handley-Page, Ltd., is now working on the following contracts:

1. Fulfilling Government contracts. They still have upwards of 1000 machines to build.
2. Running a passenger service at Hendon with five machines carrying 11 passengers apiece. Each passenger pays $10 a flight.
3. Several small contracts for the circulation of papers. The Daily Mail, the Daily Chronicle, and the Daily Telegraph, have ordered several machines apiece to be especially adapted for paper-carrying to assist in the rapid circulation of their papers.
4. Building a special machine with four engines to attempt the Atlantic flight.
5. Building a series of specially designed machines to fly Marconi wireless apparatus across the Tibetan desert to China, which has been tried by land but was found to be impossible.

Similarly the Vickers Ltd., are fulfilling a contract for 5000 double-engined bombers, of which they have so far only completed 504, so recently was the contract given.

Gets Exclusive Mail-Carrying Rights

Holt Thomas has obtained the sole rights from the British and French Governments for the carrying and delivery of mails between England and France. He is relying on this for his bread and butter, when he gets through with his present Government contracts. He is also running the present passenger service between London and Paris.

The Government is rapidly getting rid of all its obsolete types of machines by selling them at auction. Good airplanes with engines often have sold at from $1,500 to $3,000. The buyers are usually pilots of the Air Force, who have been demobilized, and who are starting in the passenger carrying business for themselves.

With regard to the smaller works, which are now left with no Government contracts, the majority are working on altogether new lines which utilize much the same type of material, and much the same type of skilled labor, as the airplane work they have been doing.

Major General Sir Frederick Sykes, K. C. B., Controller General of Aviation in Great Britain, made the following statements in a recent address to the heads of firms interested in the manufacture of aviation products:

"By May 1 the ban which has been placed on civil aviation during the war will be removed. As a result of the conferences in Paris, a draft convention has been drawn up, and it is on that that our home regulations for civilian flying will be based. It does not apply to British military aircraft.

"The first point is naturally, Who may fly? Any person wishing to fly aircraft carrying either passengers or goods must obtain a certificate to the effect that he is properly qualified to do so, and a license. Rules have been agreed on in Paris for the control of aerodrome traffic, and will be attached to the regulations, and once in the air, a definite rule of the air will be adhered to.

Will Prohibit Flying in Certain Areas

"So far as national secrecy is concerned, there will be certain prohibited areas over which none will be allowed to fly. An obvious point which has been lost sight of is the danger of alien undesirables and foreigners being landed in this country, without the police and military authorites knowing of their advent. The aliens restriction order has had provisions inserted, which cover all persons arriving in this country by air.

"The danger of smuggling by air is a very real one, and for the present it has been decided that all airplanes incoming from overseas shall only be allowed to land at four fixed aerodromes, the names and locations of which I shall give out at a later date. Persons landing elsewhere will be taken into military custody pending investigation. If, however, we find that commercial traffic develops, especially with Europe, we can always increase the number of aerodromes by an arrangement with the Customs.

"In military aviation I may say that we, through force of circumstances, lead the world. It is for us to see that we do not lose the advantage gained during the war, and that we also hold the same position in civil aviation. Flying is an international affair, and the first step has been taken to form an international code with Europe. This was the object of the Paris conference.

"Among other things agreed upon by this conference is that every machine shall be assigned a registration number, and also a nationality mark. Before these numbers are allotted, however, each machine would be inspected for design, construction, material, and actual performance in the air. All machines will be certified for a certain definite load or number of passengers, which it will not be allowed to exceed under any circumstances. Each machine will be compelled to carry log books, and will not be allowed to fly more than a certain number of hours without overhaul.

"No articles whatsoever will be allowed to be thrown overboard with the exception of water or very fine sand, as heavier articles would be likely to cause injury to people down below."

Major Foot, who is conducting a passenger carrying air line, reports that during the four days of Easter holidays his machines carried 973 passengers without accident.

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Additional International Air Rules

PARIS, April 27—The Aeronautical Commission of the Peace Conference has issued an official communiqué which outlines some additional clauses of the probable international regulations for aerial transportation. In part the communiqué says:

"The Commission has decided as a matter of principle that certificates of airworthiness in the case of the aircraft and certificates of competency in the case of the crew are to be recognized as universally necessary in international flying.

"The right of flying over a State from frontier to frontier is recognized, subject to the safeguard that the State flown over may compel a landing in the interests of national security, or, in other words, where reasonable suspicion exists that the flight is not bona fide. In the interests of domestic control by each State there are provisions as to the carriage of various papers of identity, etc., upon the aircraft, and the prohibition of the carriage of dangerous articles is also provided for.

"The final provisions include an arbitration clause for the settlement of disputes and a clause which definitely places the convention on a peace basis as not affecting the rights and duties of belligerents or neutrals. Military aircraft are placed in a class apart, and may not fly outside their own country, except by the special authorization of a State visited by them, in which case they are to be treated according to the usual rules prevailing in the case of ships of war."

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Automotive Activities in England on Increase

LONDON, ENGLAND, May 2—The automotive activities throughout the United Kingdom are showing considerable increase. The budget introduced April 30 makes no changes that concern American motor cars, but it shows a decided preference for cars manufactured in British colonies. An American car for instance would pay 33 1/3 per cent import duty while a British colony car would pay 2/3 less.

The Ford Co. has resumed building operations at its new factory at Brook Green, Hammersmith, London, and is now adding a third floor. The plan is eventually to make the building five stories. This building so far has been used more as a repairshop than as an assembly plant, but eventually will be a factory. The Ford interests have announced that the first castings have been produced at the Fordson factory in Cork. There was a celebration of this event at the factory.

The Pneumatic Tire Committee of the Society of Motor Manufacturers and Traders has taken up the work of international standardization of all solid tires. The work undertaken by this committee follows that of committees representing the British Rubber Tire Manufacturers' Association and the British Engineering Standards Committee. The object of this work is to eliminate a great number of types and sizes now on the market and to make tires interchangeable throughout the world. T. H. Woollen is chairman of this committee.

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Westinghouse Dividend

Westinghouse Electric & Manufacturing Co., Pittsburgh, 2 per cent quarterly dividend, common and preferred, common payable July 31, preferred payable July 15, both to stockholders of record July 15.

New Navigating Instruments Made for Transatlantic Flight

Take Account of the Altered Conditions Under Which Observations Must Be Taken and Permit Very Rapid Determination of Results —Equipment of Navigator's Cockpit of NC Planes

NOVEL instruments, especially designed for use in oversea navigation, are employed for the first time by the U. S. Navy-Curtiss seaplanes in the transatlantic flight.

No airplane has ever flown far enough out to sea to warrant the use of the sun, moon and stars for fixing a geographical position, as is done on seagoing ships. Navigation, therefore, on a transatlantic flight is new and untried, and it has been necessary in preparing for this flight to design three new instruments for navigational use: 1. An aerial sextant; 2, a drift and speed indicator; 3, a course and distance indicator.

A feature of the aerial sextant, known as the Byrd sextant, invented by Lieutenant R. E. Byrd, is that a bubble in a tube takes the place of the sea horizon and observations. A specially constructed lens is used in sighting the bubble, which is reflected in a mirror. The sun is reflected in another mirror. The observer brings the sun tangent to a line at the same time he brings the bubble tangent to the line. That gives the altitude of the sun. This is of especial value, as the aviator is often above the clouds. and even when flying at low altitudes the horizon is too dim to be seen clearly. With this new aerial sextant the curvature of the earth does not have to be taken into consideration in calculating position. The bubble is lighted at night, so that night observations may be taken.

New methods of astronomical calculations also have been devised which enable the navigator to make his calculations in a fifth of the time that was formerly necessary. A zenithal projection chart of the Atlantic Ocean has been specially constructed for this purpose. This chart, a new invention, does away with difficult mathematical calculations, enabling the aviator to determine his position in a few minutes.

Another great problem of the sea-air navigator is the calculation of the speed and direction of the wind, both day and night. In spite of the reliability of the compass, it can only give the course upon which the craft heads, and in determining the true course, proper allowance must be made for the sidewise drift caused by the wind. For example, a wind blowing 30 miles an hour towards the side of the plane will blow it 30 miles an hour out of its course. This fact alone makes the navigation of the air far more difficult than the navigation of the sea.

To overcome this difficulty bombs have been invented which ignite upon striking the surface of the water and give a dense smoke and bright light for ten minutes.

An instrument is used in conjunction with this bomb which enables the navigator to determine the velocity and direction of the wind by sighting on the smoke in the daytime and the lights at night. This instrument, called the speed and drift indicator, has proved successful.

When the navigator has found the speed and direction of the wind, he must then be able to calculate the course to steer towards the Azores to allow for this wind. To do this an instrument has been designed to solve the triangle of forces, thus doing away with cumbersome mathematical calculations.

The navigator's cockpit is in the fore part of the boat and is equipped with a chart board, a chart rack and lights. He also has a specially designed headgear for telephonic communication with the pilots so that he can direct them when to change course. The noise from the four big engines is so great that it is impossible to hold conversation except with specially designed telephonic apparatus.

The navigator also has instruments which show him the altitude of the plane and the time the sun keeps with the Greenwich meridian, because in going to the eastward so rapidly it is difficult to keep the correct time. In going from Newfoundland to the Azores, over two hours is lost in a period of 20 hours, so that the navigator must be very expert in order to allow for this loss in time in making his astronomical calculations.

In aerial navigation, positions must be determined very quickly. The navigator sits down to work out his "sights," to fix his position, and by the time he arrives at results he will be far from his calculated position unless he works out his calculations very rapidly, which these instruments enable him to do.

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Outstanding Aircraft Contracts

WASHINGTON, May 19—Of the Air Service contracts outstanding Nov. 9, 1918, which totaled $672,849,000, terminations to date include a total of $498,039,000. Deliveries since the signing of the armistice aggregate $160,000,000 and contracts still in force amount to $14,810,000. In percentage this results in 74 per cent of the contracts terminated, 24 per cent delivered, and 2 per cent remaining in force.

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Dealer Contracts for 150 Airplanes

CHICAGO, May 19—The James Levy Motor Corp., Buick dealer, is distributer for the central west for the United Aircraft Engineering Corp. of New York. He has contracted for 150 of the Canadian JN-4 training planes.

These planes are being sold at $2500 and are part of the equipment bought by the United Aircraft Engineering Corp. from the Canadian Government. They have a 90-hp. eight-cylinder OX-5 "V" type engine, double control, and weigh 1600 lb. They are capable of from 80 to 90 m.p.h.

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Manufacturers' Association Plans Export Trade Combine

NEW YORK, May 21—At the foreign trade session of the National Association held here last night it was proposed to form an export corporation to operate under the Webb-Pomerene law in the various Latin-American republics. This will be known as the Namusa South American Corporation and membership in it will be limited to members of the association. The plan was roughly outlined, but details are yet to be agreed upon. Approximately 60 groups of manufacturers are provided for, each concern owning one share of stock.

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Flying Fields to Be Retained

WASHINGTON, May 19—Fifteen flying fields and five balloon schools are to be held by the Air Service as permanent training fields, as follows:

Government Owned

Rockwell Field, San Diego, Cal.
Langley Field, Hampton, Va.
Post Field, Fort Sill, Okla.
Kelly Field No. 1, San Antonio, Tex.

Leased—to Be Purchased

March Field, Riverside, Cal.
Mather Field, Sacramento, Cal.
Carlstrom Field, Arcadia, Fla.
Dorr Field, Arcadia, Fla.
Ellington Field, Houston, Tex.
Park Field, Millington, Tenn.
Souther Field, Americus, Ga.
Selfridge Field, Mt. Clemens, Mich.
Scott Field, Belleville, Ill.
Chanute Field, Rantoul, Ill.
Kelly Field No. 2, San Antonio, Tex.

BALLOON SCHOOLS

Government Owned

Lee Hall, Va.
Ft. Crook, Neb.

Leased—to Be Purchased

Arcadia, Cal.
San Antonio, Tex.
Ft. Omaha, Neb.

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45,270 Planes in 9 Months

WASHINGTON, May 16—France, Great Britain and Italy produced 45,270 airplanes in the 9 months from Jan. 1 to Oct. 1, 1918, of which 79 per cent were service planes and 21 per cent were training planes. Great Britain produced 23,509; France, 1833, and Italy, 2928 airplanes.

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British Motor Trading Corp. Opening Branches Throughout England

LONDON, ENGLAND, May 2—The British Motor Trading Corp., Ltd., has been organized with a nominal capital of $10,000,000 to establish a chain of garages and motor salesrooms throughout England. The company announces that it will carry large stocks of parts for popular cars. The company is said to have placed an initial order for Crossley cars amounting to $5,000,000. These cars will be sold throughout England and Scotland.

90% Contract Claims Filed With Boards

Large Claims Still Pending—Plan for Sale of Surplus War Material

DETROIT, May 20—Having practically all of the smaller war contract aircraft and ordnance department claims in this district cleaned up, local claim adjustment boards are now engaged in routine work awaiting the presentation of a score or more large claims still pending. These big claims represent nearly 40 per cent of the total value of all contracts in this district. The boards have scores of men aiding the factory organizations in compiling the required data and excellent progress is now being made.

Among the claims still outstanding are Packard, Ford, General Motors, Willys-Overland, Lincoln, Fisher Body, Wilson Body, and a number of others. Approximately 90 per cent of all claims have been filed with the boards and about 50 per cent approved at Washington to date. The aircraft board expects to close business between June 1 and June 15. Ordnance adjustment business will be wound up about June 30.

Both boards, however, will maintain material disposal departments, which may be in operation for over a year. These departments face the huge task of selling approximately $85.000,000 worth of machinery without shaking the stability of the machinery market.

Surplus Material for Disposal

Aircraft officials estimate that it must dispose of between $40,000,000 and $50,000,000 worth of machinery, and the Ordnance Board has nearly the same amount. About 75 per cent of this machinery will be sold to the firms for which it was purchased and installed. The remaining 25 per cent will be sold in co-operation with machinery dealers.

The system for the sale of this machinery is simple but practical. A company may have installed a Government machine valued at $1000 and proposed working it on an order for 1000 certain parts, calculating that the value of the contract, when complete, would have absorbed the cost of the machine. The Government however cancelled the contract when but 500 parts had been complete, leaving the machine 50 per cent unpaid for.

The Government will estimate that inflated war prices caused the machine to sell 30 per cent higher than standard price and will therefore deduct that amount from the price which the company will be asked to pay. Wear and tear covering the period of its operation will also be deducted. This will range from 15 to 40 per cent. When this depreciation as well as the price reduction is substracted from the 50 per cent initial cost of the machine, which had not paid for itself due to contract cancellation, the cost of the machine to the company will range between $200 and $300. About 60 per cent of bureau of aircraft machinery has already been sold on this basis.

The machinery which is useless to the company which used it for war work, will be removed and sold, but the sale will be conducted in co-operation with machinery dealers. For instance, if a company bids for this Government machinery, the bidder will be obliged to purchase a machine from the dealer for every machine purchased from the Government. The Government machine will be disposed of at a price based upon market reduction, depreciation, etc., but a standard price must be paid for the new machinery.

The officials do not desire to remove machinery from a plant, place it in storage and keep it until a purchaser is found. It will exert every effort to sell the machinery to the company which used it for war work and will make further discount to such firms if they purchase it.

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President Emphasizes Industrial Needs

WASHINGTON, May 20—The industrial needs of the nation were the dominant features of the message from President Wilson to Congress, which opened here this week. He asked for:

Labor reforms that will democratize industry and bring full recognition of the rights of both the employers and employees.

Far-reaching government assistance for demobilized soldiers through the Department of the Interior which he asks to be given the necessary appropriations to develop hitherto uncultivated regions for the returning soldiers, and through the Department of Labor, which he requests be allowed to continue its employment service.

Foreign trade policies tending to establish friendliness between this country and all other nations.

A bargaining tariff so that we have a weapon of retaliation in the event that other governments enact legislation unequal in its bearing on our products as compared with the products of other countries.

Repeal of excise taxes on various manufactures and taxes on retail sales.

Return of the railroads and telegraph and telephone with legislation that will protect the interests of the owners and the nation.

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Americans to Study European Aviation

WASHINGTON, May 19—A complete study and investigation of civil aviation as being developed in Europe will be made by Assistant Secretary of War Benedict Crowell and a number of military and civil aviation authorities who will leave for Europe on May 24.

The party includes Lieut. Col. James A. Blair, of the general staff; S. S. Bradley, of the Manufacturers' Aircraft Association; G. H. Houston, president of the Wright-Martin Aircraft Corp.; C. M. Keys, vice-president of the Curtiss Airplane & Motor Corp., and Howard Coffin, of the Council of National Defense. Col. Halsey Dunwoody, chief of the air service on overseas, will join the party in France.

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Hudson Motor Co. Formed to Handle Hudson Sales

DETROIT, May 21—The Hudson Super Six and Essex in Chicago territory, formerly handled by the Louis Geyler Co., will hereafter be handled by the Hudson Motor Co. of Illinois, under active direction of J. R. Histed.

War Department Buys 200 Night Bombers

Bids Received Range from $19,500 to $60,000 for Different Quantities

WASHINGTON, May 21—The War Department will place orders this week for 200 night bombers of the Glenn-Martin type. Bids have been received from the Glen L. Martin Co., the Curtiss Aero & Motor Corp., the Gallaudet Aircraft Corp., the Boeing Airplane Co., the Liberty Iron Works, the Unit Construction Co., the L. W. F. Engineering Co. and E. Elias & Bros. Prices bid range from $19,500 to $60,000 each. The prices vary widely because the bids are for different quantities. Following is the complete tabulation of the bidders, quantities bid on and prices:

Bidder	No. of Planes	Unit Price	Total
Glen L. Martin Co., Cleveland, Ohio	50	$37,875	$1,893,750
Curtiss Aero & Motor Corp., Buffalo, N.Y.	50	25,000	1,250,000
	100	21,000	2,100,000
	150	20,000	3,000,000
	200	19,500	3,900,000
Gallaudet Aircraft Corp., East Greenwich, R. I.	30	31,000	930,000
	50	30,500	1,525,000
	100	29,500	2,950,000
	200	29,052	5,810,400
Boeing Airplane Co., Seattle, Wash.	50	37,750	1,887,500
Liberty Iron Works, Sacramento, Cal.	200	29,500	5,900,000
Unit Construction Co., Philadelphia, Pa.	25	34,740	868,500
L. W. F. Engineering Co., College Point, N. Y.	50	29,800	1,490,000
	100	27,800	2,780,000
	200	24,950	2,990,000
E. Elias & Bros., New York	1	60,000	60,000
	5	55,000	275,000
	10	50,000	500,000
	25	45,000	1,125,000
	50	42,500	2,125,000
	100	41,000	4,100,000
	200	39,750	7,950,000

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Truck Tax Reopened

NEW YORK, May 22—The Treasury Department ruling covering the tax on motor truck chassis is being reconsidered. Following protests from 57 dealer associations, including the National Automobile Dealers' Association, Commissioner Roper telegraphed the N. A. D. A. as follows: "Ruling regarding tax on chassis being reconsidered. When decision is rendered you will be notified." The ruling in question classifies a truck chassis as a part and as such requires a tax of 5 per cent. The contention is that a truck chassis is a sales unit and should be taxed as a complete unit at 3 per cent.

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Plan Committee on Aeronautics

WASHINGTON, May 20—A resolution was offered to-day in the Senate authorizing the Committee on Rules to report a Senate committee to be known as the Committee on Aeronautics. The general purpose and functions of the committee will be to consider all matters pertaining to aircraft and aviation.

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French Motoring Restrictions to Be Removed

PARIS, May 19 (Special Cable)—There is strong reason to believe that the motoring restrictions limiting travel distances will be removed this month.

The French gasoline supply is now entirely satisfactory.

Shortly after the first of the year, all gasoline purchase restrictions were removed, but travel was restricted within a radius of 30 miles of one's home. Travel was forbidden in the army zone and in the devastated regions. The removal of such limitations will throw the devastated area of France open to visitors this summer, and will doubtless lend added impetus to car production in France.

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Milton Wins at Uniontown

UNIONTOWN, May 20—Tommy Milton, driving a Duesenberg special, finished first in the Victory sweepstakes speedway race here yesterday, covering the 112½ miles in 1 hr. 10 min. 9.32 sec., averaging about 96.21 m.p.h. The race, which was scheduled to open the American racing season on Saturday, was postponed until yesterday because of rain.

Louis Chevrolet in his Frontenac special came in second.

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Willys-Overland Strike

(*Continued from page* 1132)

not be satisfactorily disposed of by the departmental shop committeemen. This plan provides for the election of committeemen by all men, including both union and non-union men, and gives fair and equitable representation to the entire shop.

Concerning female employees, the union asks that they be allowed equal pay for equal service and not be allotted tasks disproportionate to their strength. The committee states that female employees would be allowed equal pay for equal work on occupations ordinarily performed by men, and would not be given tasks disproportionate to their strength. Consistent with this policy, the company established a starting rate of 30 cents per hour for women, and installed rates in excess thereof up to 45 cents per hour.

Company Refuses Wage Increase

Regarding wages, the demand sets forth specific rates for only die makers, tool makers, die sinkers, machinists, specialists, inspectors, helpers, truckers, sweepers, elevator operators, drop forgers, blacksmiths, block and machine operators, heatrs, helpers, hammer drivers, stationary engineers, firemen, repairmen, heat system men, oilers, boiler washers, flue blowers, coal passers, mail order department men, sewing machine operators, top and body trimmers, sheet metal workers, press and bench men, solderers, helpers, pipe fitters and helpers. The increases in rates demanded were a minimum of 15 cents per hour in some cases and 25 cents per hour in other cases.

The Willys-Overland Co. in reply to this demand states that increases of 15 cents per hour to all employees and 10 per cent additional for second and third shift employees would not be granted and that the company could not afford to make a horizontal increase.

Trailer Manufacturers Want Uniform Laws

Executive Committee Passes Resolution Favoring National Highway Commission

NEW YORK, May 19—Uniform legislation and the promotion of a better public knowledge of the trailer and its uses were high points in the program outlined at an all day meeting of the executive committee of the Trailer Manufacturers' Association of America held in Association offices, 110 West 40th Street, Saturday.

As a first step it was decided to ask all members for suggestions for provisions relating to the regulation of trailers, and to incorporate these in recommendations to be sent to the Highway Industries Association with a request that they be embodied in the uniform traffic bill which was drafted by a joint committee representing the Highways Transport Committee of the Council of National Defense, the Association of State Highway Officials, the National Automobile Chamber of Commerce, the Highway Industries Association and the American Automobile Association.

It was also decided to work in conjunction with interested organizations to keep in close touch with proposed legislation, with the object of obtaining proper laws that will afford protection to the highways and their users without unwisely checking the development of economical and expeditious transportation by highway. To this end, it is proposed to arrange for the introduction of a uniform traffic bill embodying reasonable trailer regulations in the various state legislatures next winter and to get prompt advice of all other bills introduced affecting trucks and trailers.

Contact is to be established with state and local motor truck and team owners' associations, automobile clubs, good roads associations and commercial organizations, and to furnish them information and suggestions for action to be taken with respect to the various measures.

Endorse Highway Commission

As an instance of this purpose, the executive committee passed the following resolution:

Resolved, That the Trailer Manufacturers' Association of America favors the creation of a Federal Highway Commission and the construction and control of a system of national highways by the United States Government through such a commission, as provided in the Townsend bill introduced during the last session of the 65th Congress, and urges the early passage of such a measure by the 65th Congress with a view to providing better military defense, facilitating interstate transportation of persons and goods, reducing the cost of haulage by highway, increasing the production of foodstuffs, raising the standard of education and living in rural sections, and uniting the thought and sentiment of the people of the country through more frequent and easy intercourse.

In the matter of general promotion work, it was decided to make a report to members and some other trailer manufacturers covering an investigation that has been made into the merits and advantages of national publicity, and to begin efforts immediately to increase the membership of the association with a view to providing a sufficient fund for the purpose. The Southern Motor Manufacturing Association, of Houston, Texas, is the fifteenth member.

Trailer Standards Committee

A Trailer Standards Committee was appointed to confer with the Trailer Sub-Division of the Truck Standards Division of the Society of Automotive Engineers in all matters pertaining to standardization of trailers, trailer hitches, etc. The members are: W. R. Hudson, engineer of the Troy Wagon Works Co., chairman; H. G. Farr, engineer of the Martin Rocking Fifth Wheel Co., and H. W. Perry, general manager of the association.

A resolution was passed thanking the National Automobile Chamber of Commerce and R. A. Brannigan, of the N. A. C. C., for their efforts in pointing out to the Commissioner of Internal Revenue that trailers and semi-trailers are not taxable under the Revenue Act of 1918. The Treasury Department, in Regulations 47, just issued, rules that 2-wheeled and 4-wheeled trailers are exempt.

The committee considered the question of advisability of including motor truck routes as common carriers to be regulated as to routes, rates and stock issues by the Interstate Commerce Commission, as proposed tentatively by Congressman Esch. No decision with regard to recommendations was reached, but it was the general feeling that while a certain amount of regulation might be beneficial, insufficient experience in the operation of motor truck transportation lines would make it difficult and inadvisable to establish a fixed scale of shipping rates and that federal control over the organization and financing of such lines at this time might retard development of such transportation.

Standardized Cost Accounting

Use of a standardized cost accounting system for motor trucking was approved and, while not endorsing any specific system, it was the sentiment of the committee that trailer manufacturers should urge truck and trailer operators to install a uniform system so that results can be compared. The general principle of controlling trailer brakes by air pressure was also endorsed.

In July a general meeting of members of the Trailer Manufacturers' Association will be held. The date and place have not yet been set, but Rochester may be selected.

Members of the executive committee in attendance at the meeting were: President W. E. Ferris (Ohio); Second Vice-President R. C. Sykes (Troy); W. R. Bonds (Detroit); C. H. Martin (Martin); H. M. Wood (Trailmobile), representing J. C. Endebrock, secretary-treasurer; and H. W. Perry, manager of the association. Several territorial representatives of member companies were also present, including A. R. Miller of Philadelphia.

New Basis for Tractor Engine Ratings

Tractor Standards Committee of S.A.E. Discusses Uniform Standards, Rating and Legislation

CHICAGO, May 19—A more uniform basis of tractor engine ratings, more conservative rating standards and uniform and fair legislation from State Assemblies were among the topics discussed at the meeting of the Tractor Standards Committee of the Society of Automotive Engineers, May 9.

Representatives of the International Harvester Co., Advance-Rumely, Aultman-Taylor, Parrett Tractor Co., in addition to other members of the committee, including Prof. Chase of the University of Nebraska, were present.

After looking over the reports of the Winnipeg, Salina and other demonstrations it appeared foolhardy to the committee to try, with any degree of consistency, to rate tractors from the results obtained in field tests on account of the wide variation of conditions. What tractor makers generally are after now is some basis of comparison.

After considering many proposed plans for bringing this about the committee felt that the best solution at the present time would be a method similar to that used in rating cars and trucks, inasmuch as the latter method is used satisfactorily and has been accepted by all the states in issuing licenses. While it is true that a car of one make, having the same rated horsepower as a car of another make, might out-perform the latter, there nevertheless is a basis upon which to make a comparison.

The new proposed rating would establish a definite single basis on which makers could rate the ability of their tractors and incidentally make it easier for the farmer to make a selection.

Car engines are rated on about 11,733 cu. in. displacement per minute per horsepower. From the fact that cars invariably use gasoline and the duty is much lower than tractor engines, it was decided to adopt the following formula basis on about 13,000 cu. in. displacement per minute per horsepower for tractors:

$$\frac{.7854\ D^2\ LRN}{13{,}000}$$

where D is the diameter in inches of the bore, L the length of stroke, R the number of revolutions per minute, and N the number of cylinders.

Under the present rating of tractors the piston displacement runs anywhere from about 9,000 to as high as 16,000 cu. in. per min. per hp. An average taken from 12 different makes of tractors shows a piston displacement per min. per hp. of 12,696, based on the tests at Columbus, Ohio, in 1918. Also the concerns who are making tractors in any quantity come very close to the proposed 13,000 figure. Obviously if the new rating scheme is put into effect, it will mean a change in the rating of some tractors where the displacement is figured on a piston displacement per min. per hp. of less than 13,000.

The new formula may be only temporary, but it offers something for the industry to work on. It is likely that in time it will be changed, possibly reduced. In any event it will be necessary to rerate tractors whose ratings are now based on less than 13,000 cu. in. to comply with the Nebraska and other state laws.

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Tractors for Demonstration at Denver

DENVER, May 20—The following makes of tractors will participate in the tractor demonstration to be held here June 8 to 14:

All-Work	Illinois
Aultman-Taylor	I. H. C.
Avery	Lauson
Best	Leader
Case	Moline
Cleveland	National
Eagle	Parrett
Emerson-Brantingham	Rumely
Fair	R & P
Fordson	Sandusky
Four-Drive	Twin City
General Motors (GMC)	Turner
Gray	Wallace
LaCrosse	Wisconsin
Hart-Parr	Waterloo-Boy
Huber	Wheat
Holt	Bullock
	Bailor Motor Cultivator

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New Truck Tread Attachment

DETROIT, May 15—William Coatworth and M. A. Zoulek have formed the Coatworth & Zoulek Mfg. Co. here to make a truck tread attachment. It is used on both rear wheels, providing a track on which the wheels run. The attachment is made of hard wood blocks, with pipe spacers between, through which a steel cable passes. The shoes provide traction and the tread is claimed to enable a truck to pull out of mud holes.

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Improved Oil-Pressure Regulation in Liberty Engine

(*Continued from page* 1127)

oil in the pressure-gage pipe may congeal so that the gage will not register until thoroughly warmed. It is always best to drain the entire system after flights. Unless great care in warming-up is exercised, burnt-out bearings may result.

The oil and lubrication branch of the Bureau of Aircraft Production has developed an engine water heater which can be attached to each engine in active service. This consists of a small stove with several gasoline burners and a copper coil. The water from the engine cooling system circulates through this copper coil and is returned into the top of the radiator. The heater should be attached to the engine as soon as it comes in from the flight (it is only necessary to make one connection in the water return line), and it will keep the engine circulating water and oil warm. Priming the cylinders with excessive raw gasoline will wash the oil film off the cylinder walls, and scored pistons may result. Gasoline for priming should be used very sparingly, and only through the hand dash primer to the petcocks on the intake manifolds.—*Liberty Engine Service Bulletin No. 8.*

Tax on Truck Chassis Fought by N. A. D. A.

Taxed 5 Per Cent Because Classed as Part—Dealers Claim It Is Taxable at 3 Per Cent

ST. LOUIS, May 17—A vigorous fight against the ruling of the Internal Revenue Bureau that a truck chassis is a "part," and as such taxable at 5 per cent, is being made by the National Automobile Dealers' Association, through Harry G. Moock, business manager. In addition to a protest to Commissioner Roper, the association has asked the secretaries of 57 dealers' associations throughout the country, not only to wire protests on behalf of the organizations, but to have each individual member do so. The ruling is effective Feb. 25, although just announced.

The telegram of the N. A. D. A. to Roper follows:

"Treasury decision, Article 15, Regulation 47, classifying truck chassis as a part is contrary to all sales usages. Truck chassis is a sales unit, and is the basis of all truck sales regardless of the type or kind of body used. Therefore, classification as a part is not only an injustice, but greatly impedes truck sales and is a penalty on business. Revision of decision, therefore, should be made so that truck chassis when sold complete as a unit takes 3 per cent tax, which we believe was intended when the 1918 revenue bill was framed."

Here are the reasons Mr. Moock gives for the revision of the ruling:

"Dealers have been selling on the presumption that a chassis is a truck and, therefore, taxable at 3 per cent. Thus the ruling will cost the dealers thousands of dollars. The 1918 decisions of the revenue bill classified the chassis as the unit of sale. For three months the dealers have been parting with truck chassis with only a 3 per cent tax against them, as passed on by the manufacturer. It is very probable that the manufacturers, because of their contracts, will be able to collect the additional 2 per cent from their dealers, but the dealers, having completed the transaction with their customers, will be unable to collect the 2 per cent additional thus passed on."

A special war tax bulletin has been sent by the N. A. D. A. to its members, giving complete information on the decisions of the treasury department on the application of the new tax. One of the radical changes is the ruling that whenever a manufacturer overpays the tax to the government in one month he may take a credit on his next monthly return instead of having to pay the full amount due for the month and applying for a refund for the amount erroneously paid the previous month.

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Booth Making New Bumper

OWOSSO, MICH., May 19—W. S. Booth, formerly of the Field Mfg. Co. and Biggam Trailer Co., has organized a company and will begin the manufacture of an automobile bumper which he recently patented. He hopes to make 10,000 bumpers this summer. The A. E. Palmer & Sons Co. will make the bumpers for him until he gets his own plant running.

Why Secretary Houston Opposes a Federal Highway Commission at This Time

Creation of New Machinery Would Cause More Confusion Than It Would Do Good in the Present Situation, Is View of Cabinet Officer---Opposing View Held by A. A. A. Leader

WASHINGTON, May 19.—In a statement issued to-day Secretary of Agriculture Houston tells why he opposes at this time the creation of a Federal Highway Commission. He believes that the injecting of new machinery into the highway situation at this time would cause confusion that would result in much harm. At present, the Secretary says, the Federal and state organizations are being dovetailed into an organization that will work out the best solution of the present problems. The statement says:

"Before expressing my views and my opinion as to whether it would be wise to take the Federal supervision of highways from the Department of Agriculture and place it under a Federal Highway Commission, it might be well for me to point out certain fundamental considerations which should be borne in mind when determining any sound policy of highway administration and development:

Five Fundamental Considerations

"(1) The roads in each section of the country are of varying degrees of importance in the service which they render or may render to the particular locality, to the State and to the nation as a whole.

"(2) This is a big country and the traffic conditions and needs vary greatly from section to section.

"(3) The State Highway Departments, being in immediate touch with local conditions, are best able to classify the roads properly on the basis of the economic purposes which they may serve.

"(4) The Federal government, under the present Bankhead Federal Aid Road Act, is co-operating in the improvement of the roads of greatest importance, the classification of which is fixed by the State Highway Department.

"(5) When this classification has been carefully made and by agreement between the highway departments of adjoining states, the roads of first importance generally meet at state boundaries, and therefore, become interstate highways of nation-wide utility. The Federal government, under the present law, is aiding the State Highway Departments in the classification of their roads on the basis of importance and needs, and Federal aid is rapidly being extended for their improvement."

The machinery provided by the Bankhead bills insures sufficient effective control of highway construction, stated Secretary Houston, and the Federal Bureau of Public Roads is already one of the largest and most effective organizations of its kind in the world and when co-operating with the forty-eight State Highway Departments is thoroughly capable of serving the public interest and there is no need for additional machinery. Each state, he said, has accepted the Federal aid act and is already co-operating with the Department of Agriculture, having appropriated large sums, passed laws and regulations which could not easily be changed, and perhaps would not be, to conform with the Federal Highway Commission plans and instead of asking for more or different legislation, he urges to proceed actively and vigorously with the construction of roads under existing arrangements.

"I have been unable to see the need for the creation of a separate Federal Highway Commission or the wisdom of substituting for the present co-operative program," said Secretary Houston, "a plan which would commit or limit the Federal government to the construction of two Federally owned and maintained trunk lines in each state of the Union. There was a bill introduced in the Senate of the United States on Feb. 13, 1919, embodying these suggestions. This proposed legislation provides for a Federal Highway Commission of five, each receiving a salary of $10,000 a year, whose duty, among other things, would be to establish, construct, and maintain a system of highways 'to comprise not less than two main trunk line roads in each state, and joining the National Highway System in the adjacent states and countries.' The Commission is given the power to select the trunk line roads to be constructed after having requested the State Highway Departments to recommend routes. The Federal Government is to assume the maintenance of these roads. The Commission is furthermore empowered to take over the work of all existing Federal agencies relating to highway transportation and *'to purchase, lease, rent, operate, and maintain such motor and other transportation facilities as it may deem necessary in performance of its duties under this Act.'*

"In July, 1916, the Bankhead Road Act was passed. It provided appropriations out of the Federal Treasury, to be matched by equal sums from the States, for the construction of roads, and provided further that no State should receive any of the money appropriated unless it had a highway department with adequate powers. The law placed the administration of the Act in the hands of the Secretary of Agriculture, in co-operation with the 48 State highway departments. It was enacted only a short time before we entered the European war and its operation was necessarily greatly interfered with by the disturbed conditions. There were also certain features of the law that made its smooth administration difficult. After the cessation of hostilities, with the approval of the President, I requested Congress to make a large additional appropriation to aid the States in highway construction and also to make certain amendments to the law, the necessity for which experience had demonstrated. Congress, through the Bankhead amendment to the Post Office Appropriation Bill, provided an additional appropriation of $209,000,000 and substantially made the amendments suggested.

No Limitation for State Roads

"Under existing legislation, there is no special obstacle, so far as I can see, to the construction, in the different States of the Union, of those roads which serve the greatest economic needs. In the first place, the definition of the kind of roads that can be constructed has been greatly broadened and, in the second place, the limitation on the Federal contribution for any one road has been increased from $10,000 to $20,000 a mile. Following this legislation, the regulations governing the administration of the Act and the standards for plans, specifications, and estimates have been modified and one of the most successful former State highway engineers in the country has been placed in immediate charge of the Federal Aid Road work.

"He has at his disposal a considerable staff of local and district engineer aids and no pains will be spared to provide any further Federal assistance that may be needed. The machinery provided by the Bankhead amendment includes not only the Federal Bureau of Public Roads, one of the largest and most effective organizations of its kind in the world, but also the 48 State highway departments, the two agencies working in close co-operation. It is also a part of the plan to have an advisory committee, composed of representatives of the State Highway Departments, selected by the American Association of State Highway Officials with due regard to geographic considerations, to work in intimate touch with the Federal Bureau, meeting with its officers at stated periods

and at such other times as may be necessary. This machinery, in effect, is an expert national commission intimately in touch through its various parts with all sections of the Union, having no other purpose than that of serving the public interest. It is difficult to see what need there can be for additional machinery.

"Very properly the Bankhead Act places on the highway authorities of the several States responsibility, in large measure, for selecting the roads to be constructed. Obviously, the local authorities are in a better position to judge what roads would serve the largest economic needs than any group of men sitting in Washington would be. It is the duty of the Federal Bureau, with its district engineers, to see that the provisions of the law are complied with. It is giving, and will continue to give, all possible assistance to the State authorities in all their technical problems, as well as in the planning of State systems and in the classification of roads. It has been the policy of the Department from the outset, in order to prevent haphazard action, to have the State highway authorities prepare and present tentative State systems of roads.

Rigid System Inadvisable

"It was apparent that a rigid system, not subject to modifications as conditions might require, would be inadvisable. Each State authority has worked out a system and, in general, it is being followed in the development of projects and the construction of roads. In a number of instances systems in general terms have been adopted by State legislatures. Of course, in formulating these systems, the engineers gave due regard to interstate connections, that is, to roads connecting the system of one State with that of another, and it is difficult to see why, as progress is made, the construction of through roads will not follow as a matter of course.

"It seems scarcely likely, in view of the fact that nearly $300,000,000 is now available out of the Federal Treasury, that the Congress, in the light of the financial situation, will make additional large appropriations; and it would be impossible, without creating many complications, to divert the existing appropriations from the purposes and plans already under way under the co-operative arrangements with the States. A considerable part of the available appropriations has already been formally tied up under agreements with State departments and contracts for large sums have been let. Additional large amounts are being pledged monthly. Every State has accepted the Federal Act and many of them have by law directed its agencies to co-operate with the Secretary of Agriculture.

"A number of the States have large sums available for co-operation, in many instances much in excess of what is necessary to meet the requirements of the Federal Act, and other States are preparing greatly to increase their appropriations. These State laws and arrangements cannot easily be changed and perhaps would not be. After the original act was passed, more than a year elapsed before many of the States were able to secure legislative action which would enable them to comply with the Federal law and to begin the construction of roads. With the passage of the amendment carrying a large additional appropriation, there arose a necessity for further legislative action in some of the States. It seems to me that, instead of asking for more or different legislation, we should now proceed actively and vigorously with the construction of roads under existing arrangements.

No Gain by Change

"I am convinced that nothing material would be gained by the proposed change. Much would be lost. As has been pointed out, many complications would be introduced. The creation of a Commission would entail unnecessary additional administrative expenditures and the Commission could not do anything that cannot now be done more effectively by the existing co-operative machinery. There would also be a radical change of policy. I do not think that the people of the States will be willing to substitute for the present policy of developing roads on the principle of serving the largest economic purposes that policy advocated by those whose interest is in two main or trunk line automobile roads in each State, nor do I think that they would be willing, even if it were legal or practicable, to have existing funds diverted from the present or contemplated projects, worked out with the aid of the State highway departments, solely to the construction of such roads.

"By far the largest service will be rendered, not only to farmers, but, in the long run, also to urban people, by following the principle of constructing roads of the greatest economic importance, selected after careful consideration by the State agencies having adequate knowledge and approved by the Federal Department. It seems to me clear also that, as the work proceeds, we shall have roads which will be equally serviceable not only to those interested immediately in long distance automobile travel and motor truck transportation, but also to those interested in getting their farm produce to the market in the easiest and the most effective manner and in the transportation of the mails. I have no prejudice against any sort of road except a bad road, or against any sort of construction except wasteful and unsubstantial construction. If traffic conditions require heavy construction, then I am in favor of it; and in any case, under the law, the construction must be substantial.

"The road construction movement is growing very rapidly. The Federal Aid Road Act has done much to promote it. It has stimulated financial aid and has caused many State legislatures to create central highway departments. Experience has brought about amendments to the law and helpful changes in administration. Comprehensive road programs have been inaugurated. They are being pushed vigorously. They will result, in a shorter time than most people imagine, not only in a network of good substantial roads in the various States of the Union, but also in the requisite interstate highways."

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A. A. A. Leader Favors the Federal Commission

WASHINGTON, D. C., May 19—"That a commission, as contemplated by the Townsend-Bankhead bill, will be the method of administration adopted by Congress for building a National Highway System is indicated not only by public sentiment but by the weight of Government precedent," says Dr. H. M. Rowe, past president of the American Automobile Association and a member of the special committee of the A. A. A. Good Roads Board which will devote much time to Federal highway legislation.

"Highways should be considered in the same class of public activity as railways, waterways, merchant marine, the national banking system, and, in fact, any of the great distinctly national undertakings," continues Dr. Rowe. "It seems a self-evident proposition that the building of a national system of highways will form an enterprise of such magnitude and such complexity as to put it entirely beyond the sphere of a single bureau or other subdivision of an executive department and if, therefore, it be considered in the class of these greater national enterprises I have named, we should naturally expect to see the same kind of administrative machinery established for highways.

"By way of precedent, therefore, we may point out that the railroads while under government control are managed by a director-general who is not subject to the control of any Cabinet officer and that in the absence of government operation of railroads the Interstate Commerce Commission functions independently of executive departments. When we turn to the great shipbuilding and merchant marine industry, we find these are managed by the Shipping Board and the Emergency Fleet Corporation, both functioning apart from executive departments.

"There is no existing executive department which could legitimately take over the entire task of building a National Highway System. It might be contended that the Department of Agriculture should do the job because of the agricultual interests affected by highways, but immediately the counter-contention might be made that the War Department should build the system because of the military and national defense needs of the nation. The Post Office Department might very logically claim that its rural delivery and parcel post service should entitle it to control.

"The Department of the Interior, being almost entirely a public works department, might contend that a constructive engineering task should fall in its domain.

"As an outcome of these various contentions must come the realization that highways are of such an all-embracing and of such general importance as to make it impracticable to entrust the task as a minor undertaking to any single government department. A commission would consider the needs of all of the departments.

Indianapolis Picking Up on Production

INDIANAPOLIS, May 20—Local car production is on the increase, with the demand well exceeding the supply. The combined output at present is about 80 cars a day, with prospects of a considerable increase.

Pre-war production is being exceeded. The Nordyke & Marmon Co. has reached 18 cars per day, six more than its pre-war output. Its manufacturing facilities will be increased considerably when the new Liberty engine plant is devoted exclusively to passenger cars. Cole is running approximately 25 cars daily and plans to produce 5000 cars this year. Premier at present is turning out 10 cars daily. Its production has been delayed by material difficulties which are now understood to be overcome. Daily production at present is as follows: Cole, 25; Marmon, 18; National, 15; Stutz, 12; Premier, 10.

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Studebaker Additions

SOUTH BEND, IND., May 20—Additions to the plant of the Studebaker Corp. in this city will occupy 61 acres of ground when completed and will contain between 3,000,000 and 4,000,000 sq. ft. of floor space. Twelve thousand employees will be required to operate the new plant. The capacity of the establishment will be 500 cars a day.

The power house will supply 8000 horsepower. The machine shop will be a one-story saw-tooth roof building 475 by 1125 ft. The large sub-assembly and stock building will also contain the administrative offices of the production department, besides toolrooms and the machinery maintenance department. This building is to be 192 by 1057 ft. Plans provide for a foundry, press steel stamping plant, treating and carbonizing plant, closed body plant, and the final assembly building.

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American Auto Body Pays First Dividend

MILWAUKEE, WIS., May 20—A first dividend of 15 per cent has been paid to creditors of the American Auto Body Co., North Milwaukee, recently declared bankrupt. The assets were sold to E. J. Patterson for $7,750.

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Officers of Franco-American Engineering Co.

DETROIT, May 17—The officers of the Franco-American Engineering Co. besides Georges Lepere, who is president, are: Vice-president and secretary, Herbert Hughes, and treasurer, S. L. De Pue.

Industry in Cleveland Increasing Forces

Employment Service Finds Most Other Lines Have Declined 30,000 Seeking Jobs

CLEVELAND, May 20—The United States Employment Service has obtained figures from 170 Cleveland manufacturers, which reveal that there are about 20,000 fewer workmen employed in Cleveland at present than the last day before the armistice was signed. In all plants from which returns were received 77,659 persons were employed. A few industries, notably the automotive industries, report more men employed now than ever before, but this increase is more than balanced by declines in other industries.

Estimate 30,000 Unemployed

The employment service estimates that the present unemployment in the city is 30,000, which includes about 6000 building trades workers. A figure of 30,000 is about 50 per cent more than what might be called normal unemployment. Data from the 170 plants showed 77,659 men at work May 5, against 100,193 at work in 155 plants early in November.

The plants were selected as a cross-section of industry as a whole, and include a few concerns which had been working almost entirely on war work. All the large Cleveland factories are included. The average number employed in each factory is placed at 457 men. The data are to be collected every week and will be forwarded to Washington. From it and similar data collected in every employment field the government expects to have before it an exact barometer of industrial conditions.

Automotive Plants Increase Employees

The Cleveland figures bring out the curious fact that the decline in numbers employed was only 12 per cent in the 35 largest factories in their lines, while the whole decline in numbers employed in the 170 factories is about 28 per cent.

The five largest Cleveland automotive plants were employing 9535 men in November. Last week they had 9,908 on their pay-rolls. Plants depending largely on the automobile parts business were employing nearly the same numbers. This also was true of railroad shops, although the men are working shorter hours.

Steel mills are operating only part time in some instances, and one or two small mills are shut down. Practically all the men are at work, however, although at shorter hours than before and sometimes only part time. The efforts of some of the companies to Americanize their plants has resulted in the wholesale discharge of unnaturalized foreigners, and these constitute a large part of the unemployed. In some plants, employees who stayed away from work to celebrate May day were discharged.

Whatever the employment situation may be, it is apparent that the returning soldiers and sailors are taken care of. The Y. M. C. A. has ten jobs for every soldier or sailor appearing at its employment office. These are mostly shop jobs and in most cases are open only to returned service men. Six of the largest factories have 1000 jobs open to such men. The revival of navigation is giving hundreds of ex-navy men jobs. The big marine companies are giving former navy men preference, because they are naturally better adapted to lake work than any other class of labor.

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Working Conditions Service Created

WASHINGTON, May 16—The Department of Labor has organized a Working Conditions Service, including departments on industrial hygiene, research, education, standardization, safety engineering and general employment problems. The service will attempt to prevent sickness, accidents and labor disturbances and is developing a national information center on health, safety and labor in Washington. This information as gathered will be available to all industries.

Specialists will be sent upon request to various concerns requiring examination of the working conditions of plants. The industrial safety program will make examinations into engineering defects, unavoidable trade risks and those accidents caused by the human element. The employment division is collecting data on the source of labor supply, the organization of a centralized employment department, methods of employment, shop analysis, methods of "breaking in" men, promotion and transfer, turnover, absenteeism, restaurants and lunchrooms, housing, recreation, insurance and pensions.

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Tractor Sales Climbing

DETROIT, May 19—Tractor sales are climbing rapidly, according to C. E. Sorensen, general manager of Henry Ford & Son, at Dearborn, Mich. Mr. Sorensen reports splendid sales from Iowa, Nebraska, Kansas and throughout the entire wheat district; also a gaining tractor market in Texas.

Tractor sales have been distributed throughout all the season due to the unusual winter conditions. In Iowa farmers were plowing practically all winter. One retarding feature of tractor sales is the inability of farmers to secure good prices for their horses. The customary reason a farmer gives for delaying purchasing a tractor is that he cannot get enough money for his horses.

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State Roads to Aid Federal Highways

WASHINGTON, May 19—A committee of state highway officials have been appointed to co-operate with the Federal bureau of public roads to carry out the provisions of the Federal Aid Road Act. A. R. Hirst, president of the American

Association of State Highway Officials, has selected the following members for the committee: George P. Coleman, state highway commissioner of Virginia; S. E. Bradt, state superintendent of highways of Illinois; Charles J. Bennett, state highway commissioner of Connecticut; W. S. Keller, state highway engineer of Alabama, and Ira R. Browning, state road engineer of Utah.

It also was announced that the Secretary of Agriculture up to May 1 had approved 1057 project statements for Federal aid roads, involving the improvement of 10,580 miles of highways at an estimated cost of $92,933,000.

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Dealers' Association Adds Commercial Division

ST. LOUIS, May 19—A commercial division of the National Automobile Dealers' Association has been formed to handle all problems that arise solely in the truck sales field. H. N. Cartinour of the Cartinour-Bowman Co., Indianapolis, is commissioner of the new division.

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Import Restrictions Send English Car Prices Up

LONDON, ENGLAND, May 1—The direct result of the exclusion of automobile importation continues to make itself felt in the increasing price of cars. Thus the new Austin 20, which was listed at $2,000, was recently increased to $2,500. A few other examples of how prices are going up are: 12-hp. Rover, which before the war was very popular and listed at $1,750, is now selling without a single alteration at $3,500. The 11-hp. Arrol Johnston, which previous to the war sold at $1,875, is now listed at $3,500.

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National Highway Industries Assn. Commended by M. A. M. A.

WASHINGTON, May 16—The Highway Industries Association has received a special communication from the Motor and Accessory Manufacturers' Association commending it and approving its work on the plan for a Federal Highway Council.

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Additional Road Construction Planned

WASHINGTON, May 16—The U. S. Forest Service plans to construct 1643 miles of roads during 1919 at an expenditure of $12,000,000.

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Bond Issues for Road Construction

WASHINGTON, May 17—Bond issues planned or approved in 26 states for highway construction total $823,300,000. Of this, $177,800,000 have already been authorized in 7 states, $411,500,000 have been referred by legislatures in 12 states to the vote of the people, $135,000,000 are being considered in four states, and three states have voted against measures totaling $85,000,000. The issues ratified include Oregon, $10,000,000; Nevada, $1,000,000; Utah, $4,000,000; Wyoming, $2,800,000; Michigan, $50,000,000; Illinois, $60,000,000, and Pennsylvania, $50,000,000.

Bond issues which will be considered shortly include Alabama, $25,000,000; Georgia, $60,000,000; Florida, $10,000,000, and Virginia, $50,000,000. People will vote on highway bond issues in the following states: California, $40,000,000; Washington, $30,000,000; Oregon, $2,500,000; Idaho, $2,000,000; Colorado, $5,000,000; New Mexico, $2,000,000; Oklahoma, $50,000,000; Texas, $75,000,000; Minnesota, $75,000,000; West Virginia, $40,000,000; Missouri, $60,000,000; Maine, $10,000,000, and New York, $20,000,000.

United States Exports of Cars, Trucks and Parts, by Countries, During March, 1919

Countries	Commercial Number	Commercial Value	Passenger Number	Passenger Value	Parts Value
Belgium	1	$1,685	5	$4,060	$22,852
Denmark	27	27,125	15	30,184	7,332
France	166	764,125	73	170,893	131,809
Greece	1	972	10	12,798	4,737
Iceland and Faroe Islands	...	.....	2	1,271	988
Italy	...	.....	...	.....	10,798
Netherland	...	.....	...	.....	7,435
Norway	37	92,526	21	50,383	37,398
Portugal	...	.....	1	1,600	.....
Serbia, Montenegro, etc.	1	3,000	...	.....	.....
Spain	10	13,520	62	94,053	21,528
Sweden	...	.....	72	109,900	1,929
Turkey in Europe	...	.....	1	4,000	365
England	11	21,347	35	43,835	338,956
Scotland	...	.....	...	.....	1,002
British Honduras	...	.....	3	2,627	441
Canada	401	1,352,690	405	430,102	672,482
Costa Rica	...	.....	...	.....	24
Guatemala	...	.....	...	.....	1,091
Honduras	...	.....	...	.....	827
Nicaragua	4	4,511	9	5,619	2,069
Panama	1	6,000	17	13,859	6,030
Salvador	...	.....	3	5,484	3,486
Mexico	29	65,166	199	178,922	55,167
Newfoundland and Labrador	...	.....	3	2,800	2,165
Barbados	3	2,856	...	.....	2,305
Jamaica	3	1,650	8	7,011	6,852
Trinidad and Tobago	...	.....	1	875	2,043
Other British West Indies	6	3,600	2	1,040	2,113
Cuba	61	103,121	151	171,431	124,259
Virgin Islands of U. S.	...	.....	4	1,940	331
Dutch West Indies	...	.....	...	.....	726
French West Indies	6	6,016	12	9,051	3,408
Haiti	...	.....	...	.....	1,809
Dominican Republic	7	5,800	30	15,831	6,973
Argentina	7	9,675	206	223,005	209,368
Bolivia	...	.....	...	.....	2,969
Brazil	17	9,370	93	90,692	53,819
Chile	44	43,395	116	109,289	75,239
Colombia	3	2,840	26	19,235	4,489
Ecuador	...	.....	...	.....	609
British Guiana	2	1,901	2	2,500	5,039
Dutch Guiana	...	.....	...	.....	1,249
French Guiana	...	.....	...	.....	18
Peru	...	.....	14	20,880	8,716
Uruguay	12	12,000	139	149,495	55,502
Venezuela	7	4,000	22	15,263	3,578
China	67	112,995	127	185,678	28,838
Japanese China	3	5,000	7	8,486	836
Chosen	...	.....	4	3,403	.....
British India	...	.....	39	42,329	20,840
Straits Settlements	21	49,339	62	77,197	20,790
Other British East Indies	...	.....	...	.....	119
Dutch East Indies	44	82,753	158	282,380	99,204
French East Indies	6	3,430	12	9,040	470
Hongkong	...	.....	24	27,441	8,437
Japan	137	193,602	670	816,864	150,615
Russia in Asia	...	.....	3	1,900	214
Siam	3	1,613	13	13,038	559
Turkey in Asia	...	.....	...	.....	2,489
Australia	40	53,822	212	242,047	148,956
New Zealand	6	19,377	65	84,550	10,306
Other British Oceania	1	835	4	3,091	798
French Oceania	...	.....	...	.....	1,118
German Oceania	...	.....	...	.....	698
Philippine Islands	12	22,283	156	223,288	29,420
British West Africa	6	7,692	29	27,718	21,482
British South Africa	3	6,142	93	109,683	74,989
British East Africa	...	.....	1	2,091	1,898
Canary Islands	...	.....	...	.....	20
French Africa	7	6,710	10	4,932	2,199
Morocco	...	.....	2	3,100	.....
Total	1,223	$3,124,484	3,443	$4,168,184	$2,527,620
Alaska	3	$1,479	3	$3,397	$2,041
Hawaii	44	36,222	129	93,965	37,900
Porto Rico	13	39,582	49	47,001	41,791

This table supplements the one which appeared in the May 8 issue of AUTOMOTIVE INDUSTRIES, *and gives figures for all the individual countries, including those generally grouped under the collective heading of "Other Countries."*

Great Britain Removes More Import Restrictions

WASHINGTON, May 19—Pressure regulators, lubricators, grease cups, pump and engine governors, pressure and vacuum gages, copper wire, drop-forged steel and oil cans may now be imported into Great Britain without individual licenses, according to an announcement made by the War Trade Board, as all restrictions on these imports have been removed.

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Oil Restrictions Removed

WASHINGTON, May 19—All rules and regulations governing the production, manufacture, distribution or trans-

portation of oil in its various forms, including gasoline, and of natural gas were removed yesterday by an order of Fuel Administrator Garfield, which follows:

"The fuel administrator hereby orders and directs that all rules, regulations or orders heretofore issued or promulgated by or under authority of said United States fuel administrator governing licenses engaged in the business of importing, manufacturing, distributing and transporting crude oil, fuel oil, gas oil, kerosene, gasoline and natural gas or regulating the production, sale, distribution or use thereof and all amendments and modifications of said rules and regulations and orders be, and the same hereby are, vacated and set aside as of May 15, 1919."

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Exports of Automobile Tires from United States for March, 1919

Countries	Value
Belgium	$29,016
Denmark	44,468
France	64,993
Greece	605
Iceland and Faroe Islands	2,530
Italy	.....
Malta, Gozo, and Cyprus Islands	.....
Norway	91,582
Portugal	.....
Russia in Europe	.....
Spain	95,193
Sweden	8,625
Switzerland	.....
England	104,268
Bermuda	159
British Honduras	202
Canada	116,748
Costa Rica	2,614
Guatemala	2,434
Honduras	469
Nicaragua	910
Panama	20,999
Salvador	3,191
Mexico	55,511
Miquelon, Langley, etc.	.....
Newfoundland and Labrador	407
Barbadoes	2,286
Jamaica	22,747
Trinidad and Tobago	1,000
Other British West Indies	1,907
Cuba	233,855
Danish West Indies	291
Dutch West Indies	1,009
French West Indies	14,415
Haiti	217
Dominican Republic	4,646
Argentina	123,263
Bolivia	283
Brazil	82,106
Chile	45,498
Colombia	7,264
Ecuador	2,239
British Guiana	19,261
Dutch Guiana	125
French Guiana	.....
Paraguay	1,982
Peru	6,735
Uruguay	11,932
Venezuela	22,796
China	37,549
Japanese China	.....
Chosen	2,051
British India	3,366
Straits Settlements	4,070
Dutch East Indies	218,324
French East Indies	.....
Hongkong	3,473
Japan	145,269
Russia in Asia	.....
Siam	400
Australia	33,548
New Zealand	13,452
Other British Oceania	344
French Oceania	3,089
German Oceania	976
Philippine Islands	94,770
Belgian Kongo	.....
British West Africa	39,311
British South Africa	36,618
British East Africa	500
French Africa	2,839
Liberia	.....
Morocco	.....
Portuguese Africa	.....
Egypt	490
Total	$1,891,220

Government Vehicles for Public Sale

After Disposal to Government Departments About 1000 Expected to Be Left for Public

WASHINGTON, May 20—The major portion of all surplus motor trucks and cars purchased by the army will be transferred to the various Government departments. A comparatively small supply of used passenger and commercial cars of miscellaneous makes, not adapted for governmental use, will be sold at public auctions held at various military posts and camps beginning June 1.

More than 10,000 trucks, cars, ambulances and motorcycles have already been transferred by the War Department to other Government bureaus. Deliveries have been made to the Post Office Department and the Public Health Service. Of these trucks 5565 have been turned over to the Department of Agriculture and within a few days shipments of this equipment will be made by the Motor Transport Corps to Road Commissioners of the states to which allotments have been made by the Bureau of Public Roads of the Department of Agriculture.

As fast as the several states place the present consignments in operation, the Director of Sales will transfer additional trucks and road building machinery. The further needs of the Department of Agriculture, the Post Office Department and the other Government departments are expected to absorb practically the entire surplus of motor vehicles acquired for military purposes.

The motor equipment which is to be disposed of at public auction will be announced through advertisements in the press local to the communities in which the auctions will be held. The number which will be sold at auction will be very limited, and it is anticipated will number 1000. Detailed figures are not now available as it is possible that the Government bureaus will absorb all of the surplus.

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Aircraft for Forest Fires

WASHINGTON, May 20—Two routes have been established for airplane patrols for discovery of forest fires. These start and end at the March Field, 12 miles southeast of Riverside, Cal. Fires discovered will be reported by parachute messages, by special landings or by return to the base. The service will start on June 1.

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Four Permanent French Air Mail Routes

PARIS, May 10—Four aerial mail routes are about to be put on a permanent basis by the French Government. These are: Paris to Havre, Paris to Lille, Paris to London, and Paris to Brussels. Three of these lines are just ready for operation.

The Paris-Lille line has been taken over by the Breguet Co. and the Paris-London line will probably be given to a Franco-British concern. These aerial lines will not be operated direct by the French Government, but in each case by a contracting company.

In addition to the above, it is proposed to establish an aerial mail route from Paris to Nice. This will be run in two stages: the first from Paris to Lyons with stopping stations at Auxerre and Dijon, and a second stage from Lyons to Nice.

—

Moore to Double Output

DANVILLE, ILL., May 20—The Moore Motor Vehicle Co. will double its working force during June. It is claimed that by June 25 the output of the plant will reach 125 cars a day. At present the output is 62 daily.

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Export of Tractor Engines During March, 1919

Countries	Number	Value
Denmark	30	$29,781
France	214	304,862
Greece	8	12,200
Norway	8	4,906
England	148	108,745
Iceland	38	42,104
Canada	271	239,126
Honduras	2	1,820
Mexico	14	12,902
Cuba	1	1,189
Haiti	1	1,075
Dominican Republic	8	829
Argentina	52	41,698
Brazil	23	19,983
Chile	9	16,374
British Guiana	3	825
Peru	5	6,648
British India	3	2,359
Japan	1	1,108
Siam	3	8,047
Australia	26	29,316
New Zealand	1	873
Philippine Islands	28	50,281
British South Africa	15	11,924
French Africa	31	45,762
Total	943	$994,737

—

Bureau of Enemy Trade Takes Over War Intelligence

WASHINGTON, May 20—The Bureau of War Trade Intelligence has been merged with the Bureau of Enemy Trade, and such work of the Bureau of War Trade Intelligence as is still being carried on will be conducted by the Bureau of Enemy Trade.

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Markets for Motorcycles and Cars

WASHINGTON, May 19—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has received information that there are excellent markets for American motorcycles and automobiles at Antwerp, Holland, and for small and medium sizes of tractors in South Africa. There is a market for power shearers in South Africa. If manufacturers will send literature on tractors to Commercial Agent R. A. Lundquist, Durban, Natal, South Africa, he will distribute them.

Stratford Goes West to Associated Oil Co.

NEW YORK, May 16—C. W. Stratford, lubricating oil engineer of New York, has been appointed general consultant of the Associated Oil Co., San Francisco, and has left for his new position. The Associated Oil Co. heretofore has confined its work to topping only in the oil industry, but is now taking up the manufacture of lubricating oils. It is in connection with this work that Mr. Stratford has been engaged. He was formerly connected with the Tidewater Oil Co. and recently has been organizing an oil-testing laboratory at the Bureau of Standards in Washington.

—

W. K. Swigert, who has been superintendent of the Liberty airplane engine division of the Nordyke & Marmon Co., Indianapolis, since its inception a year and a half ago, will, after June 1, be in charge of development work of the Dort Motor Co., Flint.

—

A. W. Frehse has been appointed sales engineer of the wheel division of the Detroit Pressed Steel Co. Formerly he was in charge of design under the chief engineer of the Thomas B. Jeffery Co. Later he was assistant chief engineer of the Jordan Motor Car Co. He has recently been in Government service as consulting engineer.

—

S. H. Houser, formerly sales manager of the Standley Skid Chain Co., Boone, Ia., has joined the sales force of the Gray-Heath Co., Chicago.

—

Earl B. Wilson has been appointed director of sales of the Buick Motor Co. factory at Flint. Previously to that he was in charge of the Buick Chicago branch, and later was transferred to the Memphis branch. More recently he was manager of the Philadelphia branch of the Buick company.

—

A. E. Mason, who has been connected with the Chalmers Motor Co. as superintendent of sales in Wyoming and Colorado territory, is now connected with the Western Motor Car Co., Omaha, Neb.

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C. V. Lyons has been appointed eastern sales manager of the Nelson Truck Co., Saginaw, Mich. He will have charge of the distribution of the John Simmons Co., New York City.

—

Williams Beckman has resigned as experimental engineer with the Duesenberg Motors Corp., Elizabeth, N. J., to become engineer and eastern representative for the Beckman Metal Products Co., Cleveland.

—

R. H. Welles, former general manager of the Badger Brass Co., Kenosha, Wis., will be representative of Charles S. Monson, Detroit, and will have his office in Chicago.

Men of the Industry

Changes in Personnel and Position

Cadillac Sales Manager Resigns

DETROIT, May 20—S. C. Howard, sales manager of the Cadillac Motor Car Co., has resigned to take effect June 16. He will stay in the automotive business, but says he hopes to work for himself. It is rumored that he will be associated with D. McCall White in a new venture.

Mr. Howard joined the Cadillac company in 1909, coming from the National Cash Register Co., Dayton. In 1910 he was made assistant sales manager and in 1912 was promoted to sales manager.

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Blaine McGrath, former advertising manager of the Republic Motor Truck Co., has entered the sales department of the company. He has established headquarters at Birmingham and will cover Alabama and parts of Mississippi, Texas and Florida.

—

Calvert Townley, assistant to the president of the Westinghouse Electric & Mfg. Co., was elected president of the American Institute of Electrical Engineers at the annual business meeting of the Institute held Friday.

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Major B. Hawxhurst, formerly representative of the Westinghouse Co. in Detroit, is now president and general manager of the Automotive Products Co. of Detroit and Chicago.

—

F. W. Ramey, recently released as a lieutenant from military service, has been placed in charge of sales at the Cotta Transmission Co., Rockford, Ill.

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Karl A. Eichhorn, formerly of the Packard Motor Car Co., is manager of the new offices opened in Detroit by James Barr & Co., public accountants, New York City.

—

Edwin A. Godley, formerly connected with the eastern division of the Overland Motor Car Co. and with the Olds Motor Works, has been made general office manager of the Republic Motor Truck Co., Inc., Alma, Mich.

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Frederick A. Crooks has been elected president of the Biddle Motor Sales Corp. Associated with him is W. H. Howill.

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C. C. Thomas, sales engineer for the Denby Motor Truck C., Detroit, has resigned and joined the force of the Field Mfg. Co., Owosso, Mich.

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J. C. Barlow, founder and chief stockholder of the Streator Motor Car Co., Streator, Ill., is dead.

Homer Ferguson Heads U. S. Commerce Chamber

WASHINGTON, May 16—Homer L. Ferguson, of Newport News, Va., president and general manager of the Newport News Shipbuilding & Dry Dock Co., has been elected president of the Chamber of Commerce of the United States. This annoucement was made yesterday at the offices of the chamber here as the result of a mail vote of the organization's board of directors.

Mr. Ferguson succeeds Harry A. Wheeler of Chicago as president. Mr. Wheeler declined re-election after serving two separate terms. Mr. Ferguson was nominated immediately after the the chamber concluded its annual meeting at St. Louis this month, and was unopposed.

Other officers elected by the board were: Vice-president, Eastern district, A. C. Bedford, New York; North central district, Joseph H. De Frees, Chicago; South central district, Thomas F. Gailor, bishop of Tennessee, and Western district to be filled later. Honorary vice-presidents are Harry A. Wheeler, Chicago; John H. Fahey, Boston; A. B. Farquhar, York, Pa.; Charles Nagel, St. Louis, and R. G. Rhett, Charleston, S. C. The executive committee is composed of: Joseph H. De Frees, chairman; Max W. Babb, Milwaukee; A. C. Bedford, W. L. Clause, Pittsburgh; L. S. Gillette, Minneapolis; P. H. Gadsden, Charleston, S. C.; Frederick J. Koster, San Francisco; James R. MacColl, Pawtucket, R. I.; Charles A. Otis, Cleveland; Lewis E. Pierson, New York, and M. J. Saunders, New Orleans.

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Ungar Vice-President of F. R. Blair & Co., Inc.

NEW YORK, May 19—G. A. Ungar, who for several years has been engineering and technical director of the SKF Ball Bearing Co., has resigned to become vice-president of F. R. Blair & Co., Inc., of which company he has been a director since its organization. It was incorrectly reported in the May 8 issue of AUTOMOTIVE INDUSTRIES that Mr. Ungar would become vice-president of the SKF company. In his new position Mr. Ungar will have charge of the sale of Flexite specialties, of several of which he is the patentee.

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Wichita Now Mid-West Tractor

WICHITA, KAN., May 19—The Wichita Tractor Co. has changed the name of its tractor from Wichita to Mid-West, but has made no change in its firm name.

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Brotherton-Brown New Advertising Concern

Cliff Knoble, formerly advertising manager of the Liberty Motor Car Co., and Norton Brotherton, formerly of Seelye - Brotherton - Brown, advertising agents, have formed a new agency known as the Brotherton-Brown Co., with offices in Detroit.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Jordan Increasing Facilities 150 Per Cent

CLEVELAND, May 15—The Jordan Motor Car Co. is putting up additional buildings costing $175,000, designed to increase capacity 150 per cent. Five units are to be constructed, with other necessary accessories. There will be a new 2-story office building, 250 x 100 ft.; an assembly room, 100 x 300 ft.; power plant, 40 x 60 ft.; a japanning building, 50 x 100 ft., and a motor testing building, 30 x 90 ft. The present main building will be completely remodeled. There will also be built additional railroad sidings and a concrete loading platform, 600 ft. long. Work is scheduled to start immediately.

Liberty Building New Factory

DETROIT, May 19 — The Liberty Motor Car Co. will have a new factory adjacent to the Hudson Motor Car Co., the Continental Motors Co., Wadsworth Mfg. Co., Maxwell-Chalmers and a number of other automotive plants. With the new factory the company hopes to double its present production. Its present plant, the old R. C. H. corporation group of buildings, is proving unequal to present manufacturing demands.

Perfection Heater Division of Standard Parts Sold

CLEVELAND, May 16—The Perfection Heater & Manufacturing Co. has acquired the entire organization of the Perfection heater division of the Standard Parts Co. The new company, which is capitalized for $300,000, has leased a building on Carnegie Avenue, near East Sixty-fifth Street, and increased production to 1000 heaters per day. W. A. C. Smith is president, and other officers are: Vice-president and general manager, C. S. Pelton, connected for seven years with the Perfection spring and the Perfection heater divisions of the Standard Parts Co.; secretary and treasurer, F. D. Kellogg. E. L. Jones, for a number of years with the Remy Electric Co. and the Standard Parts Co., will be special factory representative. L. H. Peck, formerly machine tool designer for the Foote-Burt Co. and recently released from aviation service, has charge of engineering and production.

Wheeler Radiator & Mfg. Co. Organized

CLEVELAND, May 19—The Wheeler Radiator & Mfg. Co., organized with an authorized capital of $2,000,000, will manufacture radiators for engines. W. H. Ritter is president, and will be in charge of sales and production. G. E. Wheeler, vice-president, will have charge of manufacture, and F. R. Kissling will be superintendent. The new firm is composed principally of members of English & Mersick Co., New Haven, Conn. A small factory will be erected on 1½ acres of ground on Collamer Avenue. New buildings planned will have 100,000 sq. ft. of manufacturing space.

General Motors to Produce Half Million Vehicles Next Year

NEW YORK, May 16—The estimated output of motor vehicles of all classes by the General Motors Corp., from July 1, 1919, to June 30, 1920, is placed at 577,000. Of this total, passenger cars account for 512,000, trucks for 40,000 and tractors for 25,000. In addition, the corporation's output of farm implements is figured at 75,000. In its 41 plants General Motors employs 49,000 persons.

The General Motors company's total volume of sales for 1918, according to a booklet issued by the company, was $326,044,755, which was exceeded only by the U. S. Steel Corp., Swift & Co., Armour & Co., Bethlehem Steel Corp., Wilson & Co., and the du Pont company. Earnings on this volume, before taxes, amounted to $45,541,726. Net quick assets are shown as $150,390,492, of which more than $59,000,000 is in cash and Liberty Bonds.

Briscoe's New Car Ready

DETROIT, May 16—The new passenger car which Benjamin Briscoe and his assistant, Rodolphe Stahl, are designing for the Bellanger Freres Co., Paris, France, will be on the road in a few days. It is made entirely of American parts, most of which will be shipped to France if they cannot be manufactured at the plant of the French company.

Acason 1½-Ton Model

DETROIT, May 19 — The Acason Motor Truck Co. has completed a 1½-ton model, thus completing the line from 1 to 10-ton capacities. The new model has a Waukesha engine, Timken worm drive axle, Blood Bros. universal joints, Detroit Steel Products springs, etc., and will be equipped with either 35 x 5 front and 38 x 7 rear pneumatic cord tires or 36 x 4 front and 36 x 6 rear solid tires. It will have left hand drive.

Michigan Crankshaft Improvements

LANSING, May 15—The General Motors Corp., which recently acquired the Michigan Crankshaft properties here, is equipping, enlarging and generally improving the new property. The old shops are being reroofed and painted. It is planned to triple the capacity of the former grinding plant by new equipment and enlarged floor space. A new administration building will be erected.

New Plant for Maibohm Motors

SANDUSKY, OHIO, May 20—The Maibohm Motors Co., moving here from Racine, Wis., where its plant was destroyed by fire, will occupy a new factory having 75,000 sq. ft. of floor space. The plant will be 620 x 120 ft., located on a 15-acre site. It will be of one story, sawtooth design and modern fireproof, day-light construction. It will have a capacity of 50 machines daily.

Packard Establishes Experimental Flying Field

DETROIT, May 17—The Packard Motor Car Co. has acquired a tract of land between this city and Mt. Clemens for use as a private experimental flying field in the development of its aviation program. The company will begin immediately to grade, tile and seed the new field and will erect buildings as they are needed. It should be ready for operation by midsummer.

Extra Charge for Canadian Ford Electrical Equipment

DETROIT, May 16—Canadian Ford touring cars and roadsters will be supplied with starting and lighting devices as optional equipment at an extra charge after June 1. All Canadian closed models now have the starters as part of standard equipment.

Blood & Co. to Handle Motor Exports

New YORK, May 19—W. D. Blood & Co., Inc., has recently been incorporated to handle American manufactures in foreign fields, especially automotive and hardware manufactures. W. D. Blood is president in charge of sales. He was manager of the export department of the Hendee Mfg. Co. for 7 years. John C. Gallagher is secretary and treasurer. He will be in charge of the main office at 44 Whitehall Street.

The company will have permanent representation in the South American countries. At the present time it is acting for the following concerns: Metz Corp., Waltham, Mass.; Corbin Screw Corp., New Britain, Conn.; Hawthorne Co., Bridgeport, Conn.; Witherbee Igniter Co., Springfield, Mass.; Witherbee Storage Battery Co., New York City; L. F. Benton Co., Vergennes, Vt.

Two Companies Bought by Bull Tractor-Madison Motors

ANDERSON, IND., May 19—The Bull Tractor-Madison Motors Corp. has acquired the factories and business of the Bull Tractor Co., Minneapolis, and the Madison Motor Car Co. The new company will manufacture the Bull tractor and the Madison motor car.

New Factory for Turnsted

DETROIT, May 16—Work is about completed on the new plant of the Turnsted Mfg. Co., a subsidiary of the Fisher Body Corp., and the company is preparing to move into its new quarters. The plant has a floor space of 100,000 sq. ft.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb..... .02 - .03
Phosphoric (85%), lb..... .35 - .39
Sulphuric (60%), lb..... .008

Aluminum:
Ingot, lb..... .33
Sheets (18 gage or more), lb..... .42

Antimony, lb..... .07½

Burlap:
8 oz., yd..... .08¾ - .09
10½ oz., yd..... .10¾ - .11

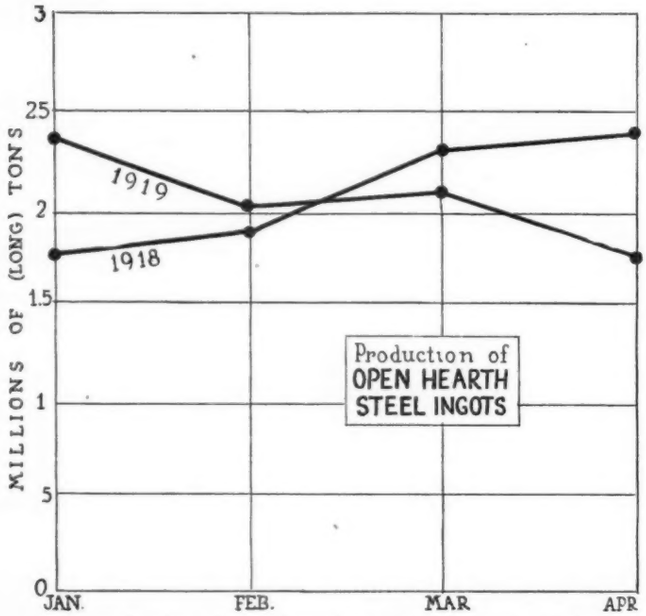
Copper:
Elec., lb..... .16⅜ - .16½
Lake, lb..... .16¼ - .16½

Fabric, Tire (17¼ oz.):
Sea Is., combed, sq. yd. 1.40
Egypt, combed, sq. yd. 1.25
Egypt, carded, sq. yd. 1.20
Peelers, combed, sq. yd. 1.08
Peelers, carded, sq. yd. .85

Fibre (⅛ in. sheet base), lb..... .50

Graphite:
Ceylon, lb..... .09 - .22
Madagascar, lb.... .10 - .15
Mexico, lb..... .03¾

Lead, lb..... .05 - .05½



The production of open-hearth steel ingots in the United States shows an appreciable falling off during April, 1919. *Output for that month was* 1,732,447 *tons as against* 2,377,974 *tons in April,* 1918

Leather:
Hides, lb..... .25 - .46

Nickel, lb..... .40

Oil:
Petroleum (crude):
Kansas, bbl.....2.25
Pennsy., bbl.....4.00
Gasoline:
Auto, gal..... .24½
68 to 70 gal..... .30½
Lard:
Prime City, gal.2.70
Ex. No. 1, gal....1.15 -1.20
Linseed, gal.....1.56
Menhaden (dark), gal..... .75 - .80

Rubber:
Plantation:
First latex pale crepe, lb..... .46
Brown crepe, thin, clear, lb..... .41½ - .42
Smoked, ribbed sheets, lb..... .45

Para:
Up River, fine, lb. .56¼
Up River, coarse, lb..... .34½ - .34⅜
Island, fine, lb.. .47 - .47½

Shellac (orange), lb. .62 - .68

Spelter, lb..... .06⅛ - .06¾

Steel:
Angle beams and channels, lb..... .02½ - .03
Automobile sheet (see sp. table).
Cold rolled, lb.... .04¼ - .04½
Hot rolled, lb..... .03½ - .03¾

Tin ..... .72½

Waste (cotton), lb.. .12¾ - .17

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lbs.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lbs.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lbs.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lbs.

Blank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.

Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close May 17

	Bid	Asked	Net Ch'ge
Auto Body Company... ..	9	10	..
Briscoe Motor Car com...	14	..	..
Briscoe Motor Car pfd....	50	65	..
*Chandler Motor Car.....	155¼	157¼	+6¼
Chevrolet Motor Car.....	209	211	..
Cole Motor Car Co.....	120	125	..
Continental Motors com..	8⅝	9	—⅜
Continental Motors pfd...	96	99	..
Edmunds & Jones com....	28	30	—1
Edmunds & Jones pfd....	75	80	..
Electric Storage Bat.....	76	78	..
Federal Motor Truck.....	42	44	..
Fisher Body Co. com.....	73⅜	75⅜	+16⅜
Fisher Body Co. pfd.....	98	101	+6
Ford Motor of Canada....	320	330	..
General Motors com.....	185	186	—3½
General Motors pfd.....	89¾	91¾	—2
Hupp Motor Car com.....	8¾	9¼	..
Hupp Motor Car pfd.....	98	101	..
Kelsey Wheel Co. com....	35	37	..
Kelsey Wheel Co. pfd....	93	95	..
Manhattan Electric S com. ..		48	..
Maxwell Motor com.....	45⅜	46⅜	+3⅞
Maxwell Motor 1st pfd....	71¼	72¼	+2¾
Maxwell Motor 2d pfd.....	33¼	34¼	+ ¾
McCord Mfg. com.....	40	41	— ½
McCord Mfg. pfd.....102		..	+2
Mitchell Motor Co.....	45	47	..
Motor Products Corp.....	45	50	..
Nash Motors Co. com.....230		..	..
Nash Motors Co. pfd.....	96	100	+1
National Motor Co.....	16	20	..
Packard Motor Car com..	190	195	+20
Packard Motor Car pfd....100		102	*..
Paige-Detroit Motor com..	38	39	— ½
Paige-Detroit Motor pfd..	9	9¾	..
Peerless Motor Truck.....	34	35	+5
*Pierce-Arrow M. Car com	50½	51½	+1⅛
Pierce-Arrow M. Car pfd.102		104	..
Premier Motor Corp. com..	5	..	..
Premier Motor Corp. pfd..	..	75	..
Prudden Wheel Company..	21	22	..
Reo Motor Car Co.....	29	30	—2
Republic M. Truck com...	46	47	—2
Republic M. Truck pfd....	91	95	..
Saxon Motor Car com....	8	10	+1⅛
Scripps-Booth Corp.	25	30	..
Stewart-Warner S. Corp.	90	92	— ½
Stromberg Carburetor Co..	38	40	..
Studebaker Corp. com....	82	83	+4¼
Studebaker Corp. pfd.....	94	97	..
Stutz Motor Car Co.....	57½	58½	— ¼
United Motors Corp. pfd..	47	49	..
White Motor Co.....	57¾	58¾	+ ¼
Willys-Overland com.	34⅛	35⅛	+ ⅞
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.....	88	90	..
Firestone T. & R. com....158		161	+5
Firestone T. & R. pfd....100		101	..
Fisk Rubber Co. com.....135		142	—14
Fisk Rubber 1st pfd.....100		105	..
Fisk Rubber 2d pfd.....135		142	—14
Fisk Rubber 1st pfd conv.105		110	..
*Goodrich, B. F., com....	71½	72½	+1½
*Goodrich, B. F., pfd.....107½		109½	+ ½
Goodyear T. & R. com...330		340	+7
Goodyear T. & R. 1st pfd.106		108	..
*Goodyear T. & R. 2d pfd.107½		109	+ ½
*Kelly-Springfield com....122¼		123¼	—1⅞
Kelly-Springfield pfd.....	95	97	..
Lee Tire & Rubber Co...	32½	33½	— ⅝
Marathon Tire & Rubber.	55	65	..
Miller Rubber Co. com....200		207	+15
Miller Rubber Co. pfd.....105		106	..
Rubber Products Co.....155		160	+26
Portage Rubber Co. com..171		174	+16
Swinehart T. & R. Co....	88	93	+10
U. S. Rubber Co. com....	98	99	+3¼
*U. S. Rubber Co. pfd.....113¼		114¼	+ ¾

*Ex dividend.

Air Mail Service Profitable in First Year of Operation

(*Continued from page* 1106)

a plane having a top speed of 75 or 80 miles against a surface wind of 40 miles or more an hour. The two types of planes in the Aerial Mail Service of this speed are the Standard JR1 mail plane, having a wing spread of 31 ft. 4 in., and the Curtiss JN-4-H, having a wing spread of 43 ft. 7⅜ in. Each type of plane is equipped with a 150-hp. motor. The motor of this strength has not enough reserve power to combat the disturbed air conditions at the surface in a wind of more than 40 m.p.h., especially so if the wind comes in descending columns or gusts. Under these conditions it is possible to make headway only with a Liberty engine, which has plenty of reserve power.

A plane equipped with a 150-hp. motor, if it succeeds in breaking through the surface wind, can make only slow and laborious headway against a full or a quartering head wind of about 40 miles. There have been many instances where the planes equipped with 150-hp. motors have been held down to a speed of between 30 and 37 m.p.h.; also many instances where a 100-m.p.h. plane equipped with Liberty motor has been held to between 55 and 60 m.p.h. of speed. A few windstorm conditions were encountered on trips where the planes at the height of the gusts were actually carried backwards.

Two Periods of Remarkable Gales

There were two periods of remarkable gales encountered during the year. One was on December 6, 1918, on the Washington-Philadelphia flight. On that day the wind reached a maximum of 50 m.p.h. at College Park, Md., during the flying hours. It blew the plane around like a leaf and put down the first small plane that attempted to get out, damaging the machine. A second plane with 150-hp. engine got through the disturbed conditions, and at an altitude of 500 ft., above which it could not rise. The wind was so powerful that it took in excess of one hour for the plane to travel from College Park to Laurel, Md., a distance of less than 12 miles.

On the same day the plane leaving Philadelphia for Washington encountered a 60-mile wind, against which it battled for 2 hr. and 41 min., in which time it covered only 113 miles.

The other gale period began on the afternoon of March 27, overtaking two of the mail flyers in the air. It helped one along on his route, but forced the other to land, the maximum velocity of the wind being 45 m.p.h. This gale grew in intensity and blew unabated on March 28 and 29, and on these two days the most remarkable flight in all history of aviation was undertaken in the face of the storm. At College Park an aviator made three attempts to take off in the storm, feeling that once above the disturbed surface conditions he could continue on his way. The highest altitude with the 150-hp. motor he could reach was 140 feet, at which height, as in the case of the other two attempts, descending currents of air pressed his machine down to the ground with such force as to injure the landing gear. The maximum ground velocity at College Park at the time the attempts were made was 46 m.p.h., but the air currents were in a great state of disturbance. The weather observer's report for Washington for this day is as follows:

"Heavy northwest gale continued throughout the day and night. Some houses were unroofed, according to press reports, and many trees were uprooted. Wire communication was interfered with. A two-masted schooner was reported sunk and crew lost 70 miles below Washington. The wind at times attained an extreme velocity of 55 miles."

At Belmont Field, Long Island, attempts were made to get away with the mail in a small motor plane in a surface wind of 54 m.p.h. The attempts with the small planes were made at the suggestion of the pilots, who believed an airplane with small wing spread stood a better chance in the gale than one of a larger wing spread, even though equipped with greater power. At Philadelphia the reserve air-mail pilot, J. N. Miller, who was a former naval flyer, essayed the trip with a Curtiss R-4 plane of 48 ft. 4⅛ in. wing spread and powered with a 400-hp. Liberty engine. He rose against a surface of wind of 43 m.p.h. and flew by compass into a snow storm then raging over New York City, and picked up a land mark in the Woolworth Tower, 300 feet above its spire, and then directed his course through the gale and storm, which the Weather Bureau reports at that hour as having a maximum velocity on the ground at New York of 68 m.p.h. The velocity of the wind was 15 per cent greater at the altitude at which this pilot was flying than on the ground. Telegraphic reports from Belmont Field at the time reported visibility at 50 ft. on the field, and the flyer, not being able to pick it up, landed at Great Neck, Long Island, a short distance beyond the aerial mail field. He set down his plane with damage to landing gear. The Weather Bureau reported on the gale over New York that day as follows:

"Snow squalls at times were heavy, obstructing the view in the harbor and interfering with traffic. Maximum wind velocity was 92 m.p.h., a record surpassed only once at this station—recorded at 9.25 p. m. The average velocity for the last 12 hr. was 62 miles, and for the last 6 hr. was 68 miles. According to the city press, the loss of life and damage to property was considerable."

At 3.25 p. m., at which time the air-mail pilot was struggling with the gale over New York City, the maximum velocity of the wind recorded by the Weather Bureau at New York was 68 m.p.h. on the ground. The performance of this flight for courage and successful handling of an airplane has never been surpassed, perhaps never equalled.

NOTE.—This pilot returned to Philadelphia by train that night and the following day he repeated the performance under almost as bad conditions.

On March 29, at College Park, the air-mail pilot again undertook three times to get under way in a small plane with 150-hp. engine. The larger plane with the Liberty engine had been rendered unserviceable by the collapse of a tent in the storm. The highest elevation reached on that day was 150 ft. In each of the three attempts the wind forced the plane almost vertically to the ground, setting it on its nose each time, resulting in broken propellers. The gale was blowing in gusts at a maximum of between 38 and 40 m.p.h. At Philadelphia the same air pilot who had flown the day before with the Curtiss R-4 and the Liberty engine, took off in a 42-mile gale with a DH-4 airplane run by a 400-hp. Liberty engine. He had better visibility on his trip, but he flew through a gale that was blowing at a maximum of 80 m.p.h. when he successfully landed with the mail at Belmont Park at 4.45 p. m.

Weather Bureau's report on wind velocity at New York City during the hours of operating the aerial mail follows:

Miles Per Hour.

	Noon to 1 P.M.	1 to 2 P.M.	2 to 3 P.M.	3 to 4 P.M.	4 to 5 P.M.
March 28.....	54	49	67	68	78
March 29.....	75	77	78	77	80

One of the first studies which were taken up by the Aerial Mail Service was to determine whether visibility is absolutely necessary to commercial flying by airplane. Assuming that forced landings have been eliminated, except under the rarest circumstances, through multiple motors accessible for repair in the air, the question then resolves itself to this: Is visibility necessary to landing on a prepared aviation field?

The first step necessary was the refinement of the existing radio direction finders to such a point as to eliminate the liability of 3 to 5 per cent of error and make absolutely certain the bringing of the ship directly to or over the field. This has been successfully worked out by the Navy Department on an aerial-mail testing plane.

The second problem was of guiding the mail plane to the center of the plot for landing. This problem has been solved by the Bureau of Standards of the Department of Commerce

in experiments conducted on the aerial-mail testing ship in connection with radio directional compass. At this time the device of the Bureau of Standards is entirely effective up to an altitude of 1,500 feet, and the refinements upon which the Bureau is at work should give it an altitude of another thousand or more feet, by means of this device the aviator circling around the field and coming down with the head of the machine always to the center of the field for the purpose of making a landing. At present a visibility on the ground of between 20 and 50 ft. vertical is necessary to enable him to gage when to set the plane down. Aeronautical engineers are working on a device for the automatic landing of a mechanically flown airplane. Such a device, or any device that will give altitude without reference to the barograph, should solve this problem. The condition of absolute invisibility requiring such a device would rarely arise, and exist only in the most blinding snowstorm, down-pour of rain, or impenetrable ground fog.

A year's flying of the aerial mail with all types and temperaments of aviators establishes the fact that 200 ft. visibility from the ground is the limit of practical flying, although a number of runs were made with the mail between New York and Washington in which a part of the trip was flown at the low elevation of 50 feet. The objection of aviators to flying above a ground fog, rain, snow or clouds with single-motor planes is due to the possibility of the motor stopping over a village or city, or bad ground, with the visibility of such a short radius that it would be impossible after gliding through the cloud or fog strata to pick a safe spot to land, whereas, if they fly just on the lower edge of the thick strata with the land constantly before them, they are in a position to skirt around the edges of cities, towns, timber, or other terrain for landing. It is generally accepted that with two or more motors the flights will be made above the clouds or fogs or rain banks, certainly as long as enough motors are running to hold an altitude. It is also clear that in a twin-motor plane, should one motor die, although the other motor is capable of carrying the plane forward, the pilot would come down below the area of invisibility and fly low as in the case of a single-motor plane.

During the year of operations a very careful record has been kept of the mechanical causes of forced landings. These have been entirely connected with the motor. There have been a total of 37 forced landings due to motor trouble, which is one forced landing for every 3460 miles flown.

Of the motor troubles sufficient to bring down a mail plane six have been due to ignition trouble, five of the six resulting from magneto disturbance, most frequently the shearing of a shaft. Disarrangement of the distributor and the failure of a generator for a Liberty engine were responsible for the other two forced landings chargeable to ignition. Work has begun in installing duplicate ignition systems for each engine, which will largely obviate forced landings from this source.

Leaking radiators or water lines are responsible for seven forced landings. It is believed that trouble from this source will be minimized by the installation of a radiator in the wing now fastened between the propeller and the engine in a position where it catches the vibrations of both the propeller and the engine.

Two forced landings resulted from valve trouble on Hispano-Suiza motors, the valves of these engines being an inherent weakness of the motor. This is a serious problem, and the Bureau of Standards has undertaken an investigation of methods to overcome it.

Failure of the gas pressure resulted in one forced landing, and this is easily remedied by the installation of an auxiliary gas tank on each plane.

Two forced landings resulted from carbureter trouble, the overcoming of which is now being studied.

There have been eight forced landings due to spark-plug fouling. This trouble can arise from several causes. It most frequently results from idling the engine in the preliminary warming-up stage before a flight. The Aerial Mail Service has urged spark-plug inventors to perfect this mechanism, and as the result of the assistance rendered one inventor has finally developed a spark plug which gives promise of entirely eliminating fouling. A set of these plugs in one bank of the low-compression Liberty engine operated 25 hr. in a test ship without being withdrawn from the cylinder for the purpose of cleaning. The plugs were then withdrawn and placed in service and have functioned perfectly. An order has been placed for this type of plugs for high compression as well as low compression Liberty and Hispano-Suiza motors.

A study of the motor troubles causing forced landings points irresistibly to the multiple engine as a solution. A multiple-power plane must be of such character that with half the power gone the remaining power will carry the airplane to its destination. Thus, in case of two motors, one motor should enable the pilot to continue his trip though at greatly reduced speed. In a three-motored plane it should be necessary to lose a second engine before a forced landing has to be made. In the specially constructed mail-carrying planes which the Department has outlined in bids to be opened on June 2, a form of construction is called for that will enable a mechanic to make important minor repairs in flight. Under these conditions it will be possible with a multiple motor to insure maintenance in the air until the objective point or terminus is reached.

OTTO PRAEGER,
Second Assistant Postmaster General.

Calendar

SHOWS

May 15-June 1—Venezuela. National Exhibit of Venezuela.
*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.
Nov. 7-15—London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.
December — Brussels. International Automobile Mfrs. Congress.
January—New York. International Automobile Mfrs. Congress.
February — Chicago. International Automobile Mfrs. Congress.
Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

May 30—College Park, Md. — Power cultivator Demonstration. Maryland State Dept. of Agriculture.
June 8-14—Denver, Col. Sectional Tractor Demonstrations. Denver Tractor Club.
July 14—Wichita, Kan. Automotive Committee of National Implement Assn.
Aug. 18-22—Aberdeen, S. D. Sectional Tractor Demonstrations.
October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

CONTESTS

May 23—San Joaquin, Cal.—Grade 2 non-stock cars, reliability contest, San Joaquin Auto Trade Association.
May 30—Atlantic City, N. J.—Airplane races—Aeronautic Convention.
May 30-31—Richmond Va.—2-Day Dirt Track Meet, Virginia State Fair Grounds Track.
†May 30-31—Los Angeles, Cal.—Los Angeles-Yosemite 3rd annual gasoline economy run.
†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.
*June 14—Sheepshead Bay, L. I. Speedway race.
July 4—Atlantic City, N. J.—Airplane races—Aeronautic Convention.
*July 5—Cincinnati, O., Speedway.
*July 19—Uniontown, Pa. Speedway race.
*July 26—Sheepshead Bay, L. I. Speedway race.
*Aug. 15 — Middletown, N. Y. Dirt track event.
*Aug. 22-23—Elgin, Ill. Road race.
*Aug. 23—Sheepshead Bay, L. I. Speedway race.
*Sept. 1—Uniontown, Pa. Speedway race.
*Sept. 20—Sheepshead Bay, L. I. Speedway race.
*Sept. 27—Allentown, Pa. Dirt track event.
*Oct. 1—Cincinnati, O. Speedway race.
*Oct. 4—Trenton, N. J.—Dirt Track Event.
*Oct. 11—Danbury, Conn.—Dirt Track Event.

†Sanctioned.
*Tentative dates.

CONVENTIONS

May 1-June 1—Atlantic City, N. J. — Pan-American Aeronautic Convention and Exhibition—Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.
May 21-24—Washington — Conference on Weights and Measures—Bureau of Standards.
June 2—Chicago, Ill.—Natl. Gas Engine Assn. Hotel Sherman.
June 2-6—Hot Springs, Va. Convention Automotive Equipment Assn., Homestead Hotel.
June 3-6 — Washington, Pan-American Commercial Conference, Pan-American Building.
June 23-28—Ottawa Beach, Mich.—S. A. E. Mid-summer Meeting.
Sept. 22-24 — Philadelphia. Annual Convention. National Association of Purchasing Agents, Bellevue-Stratford.